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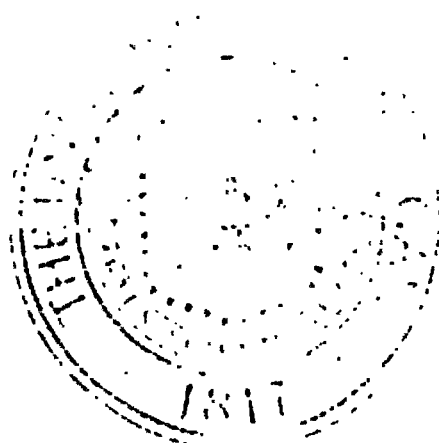
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1824-1921

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BANES, CHARLES H., 1886	ROGERS, ROBERT E., 1875-1878
BIRKINBINE, JOHN, 1897-1906	RONALDSON, JAMES, 1824-1841
CLARK, WALTON, 1907-	SELLERS, COLEMAN, 1870-1874
CRESSON, JOHN C., 1855-1863	SELLERS, WILLIAM, 1864-1866
MERRICK, J. VAUGHAN, 1867-1869	TATHAM, WILLIAM P., 1879-1885
MERRICK, SAMUEL V., 1842-1854	WILSON, JOSEPH M., 1887-1896

## VICE-PRESIDENTS

AGNEW, JOHN, 1851, 1855-1863	HOWSON, HENRY, 1904-
BALDWIN, MATTHIAS W., 1855-1863	JONES, WASHINGTON, 1900-1910
BECK, PAUL, JR., 1826-1827	LEVY, LOUIS E., 1916-1919
BULLOCK, CHARLES, 1879-1900	LONGSTRETH, EDWARD, 1890-1894
CAREY, MATTHEW, 1824-1828	LUKENS, ISAIAH, 1824-1825, 1829-1846
CARTWRIGHT, HENRY, 1880-1881	MILLER, ABRAHAM, 1847-1854
CHRISTIE, JAMES, 1911	MITCHELL, J. E., 1876-1887
CLOSE, CHARLES S., 1875-1879	MOORE, BLOOMFIELD H., 1869-1876
CRESSON, GEORGE V., 1898-1903	MORRIS, HENRY G., 1870-1879
DAY, CHARLES, 1920-	RAND, THEODORE D., 1897-1903
DODGE, JAMES M., 1903-1915	ROGERS, FAIRMAN, 1864-1866
EREBY, GEORGE, 1867	ROGERS, ROBERT E., 1868-1874
FLETCHER, THOMAS, 1828-1850, 1852-1854	SELLERS, COLEMAN, 1867-1869
FRAZER, JOHN F., 1865-1866	SELLERS, COLEMAN, JR., 1912-
GRAFF, FREDERICK, 1882-1890	TATHAM, WILLIAM P., 1888-1897
HEYL, HENRY R., 1895-1897	TOWNE, JOHN H., 1864-1868

## RECORDING SECRETARIES

BULKLEY, JAMES H., 1831-1832	PEROT, WILLIAM S., 1833-1834
GARRIGUES, ISAAC B., 1830, 1837-1863	ROBERTS, ALGERNON S., 1829
JONES, THOMAS P., 1827-1828	STRICKLAND, WILLIAM, 1824-1826
JONES, WASHINGTON, 1864	TRAUTWINE, JOHN C., 1835-1836

## CORRESPONDING SECRETARIES

BACHE, ALEX. DALLAS, 1840-1844	FRALEY, FREDERICK, 1855-1863
BRIGGS, ROBERT, 1864	FRAZER, JOHN F., 1845-1847
BROWNE, PETER A., 1824-1827	HAYS, ISAAC, 1828-1839
CRESSON, JOHN C., 1854	ROBERTS, SOLOMON W., 1848-1853

## SECRETARIES

CHRISTIE, JAMES, 1909  
 KNIGHT, J. B., 1875-1879  
 MORTON, HENRY, 1865-1870  
 NORRIS, ISAAC, 1879-1881

OWENS, ROBERT B., 1910  
 WAHL, WILLIAM H., 1871-1874, 1882-1908

## TREASURERS

BORGNER, CYRUS, 1908-1920  
 FLETCHER, THOMAS, 1824-1825  
 FRALEY, FREDERICK, 1830-1847, 1865-1882  
 FRANKLIN, BENJAMIN, 1920-  
 FRAZER, JOHN F., 1848-1864

MERRICK, SAMUEL V., 1828-1829  
 RICHARDSON, JOHN, 1826-1827  
 SARTAIN, SAMUEL, 1883-1906  
 TREGO, CHARLES B., 1847  
 WAHL, WILLIAM H., 1907

## ACTUARIES

CHRISTIE, JAMES, Feb. 21-June 11, 1908  
 HAMILTON, WILLIAM, 1828-1871  
 HEYL, HERBERT L., 1885-1908  
 HOLMAN, DAVID S., 1872-1885

JESTER, SIMEON VAN T., 1916-1918  
 LARZELERE, JAMES S., 1908-1916  
 ROBINSON, LOUIS C., 1918-  
 WAHL, WILLIAM H., 1872

## LIBRARIANS

HILTEBRAND, EMANUEL, 1874-1887

RIGLING, ALFRED, 1887-

## MANAGERS

ABBOT, WILLIAM, 1824-1826  
 ADAMSON, WILLIAM, 1864  
 ADDICKS, JOHN E., 1845-1850  
 AGNEW, JOHN, 1831-1850, 1852-1854  
 ALLEMAN, GELLERT, 1918-  
 ALLEN, JAMES, 1845  
 ALLISON, WILLIAM C., 1863  
 ARCHER, ELLIS S., 1858-1859  
 BACHE, ALEX. DALLAS, 1830-1839  
 BALCH, EDWIN S., 1902-1912  
 BALDWIN, MATTHIAS W., 1827-1854  
 BANES, CHARLES H., 1877-1885, 1887-1895  
 BARKER, GEORGE F., 1874-1875  
 BARRAS, JOSEPH J., 1851-1860  
 BARTOL, BARNABAS H., 1863-1865  
 BARTOL, HENRY W., 1870-1878  
 BAUGH, DANIEL, 1900-1902

BAUGH, HARMAN, 1855  
 BEALE, JOSEPH, 1827  
 BEARDSLEY, ARTHUR, 1894-1902  
 BECK, PAUL, JR., 1824-1825  
 BEMENT, CLARENCE S., 1871  
 BEMENT, WILLIAM B., 1866-1870  
 BERGNER, THEODORE, 1870-1875  
 BETTS, WILLIAM C., 1844  
 BIDDLE, CLEMENT C., 1824  
 BILGRAM, HUGO, 1885-1890  
 BIRKBECK, JOHN, 1869-1871  
 BIRKINBINE, HENRY P. M., 1851-1856  
 BIRKINBINE, JOHN, 1907-1915  
 BOLTON, JAMES M., 1830  
 BONINE, CHARLES E., 1921-  
 BORGNER, CYRUS, 1903-1907  
 BOSWELL, WILLIAM L., 1896-1898  
 BOWER, HENRY, 1891-1896

## MANAGERS—(Continued)

- BRIGGS, ROBERT, 1867-1873  
 BROCK, ROBERT C. H., 1901-1906  
 BROLASKY, HENRY C., 1897-1902  
 BRYSON, JAMES H., 1857-1863  
 BULKLEY, JAMES H., 1830, 1833-1841  
 BULLOCK, CHARLES, 1868-1878  
 BURNHAM, GEORGE, 1878  
 BURTIS, AARON H., 1845  
 CARR, WILLIAM H., 1837-1845  
 CARTWRIGHT, HENRY, 1865-1879  
 CHABOT, CYPRIEN, 1877-1889  
 CHAMBERS, CYRUS, JR., 1876-1890  
 CHAMBERS, FRANCIS T., 1913-  
 CHASE, PLINY E., 1864-1886  
 CHRISTIE, JAMES, 1897-1908  
 CLAMER, G. H., 1917-  
 CLARK, THEOBALD F., 1917-  
 CLARK, WALTON, 1903-1906  
 CLARKE, JAMES, 1824-1826  
 CLOSE, CHARLES S., 1865-1874  
 CLOUD, JOSEPH, 1824  
 CODMAN, JOHN E., 1892-1894  
 COLLINS, ISAAC, 1828  
 CONARD, THOMAS P., 1894-1908  
 CONARROE, GEORGE W., 1851-1863  
 COOPER, JOHN H., 1870-1873  
 COPPER, JOHN C., 1851  
 CORNELIUS, ROBERT, 1855-1863  
 CORNELIUS, ROBERT C., 1866-1868  
 CRAMP, CHARLES H., 1864-1867,  
 1875, 1895-1897  
 CRESSON, GEORGE V., 1886-1897  
 CRESSON, JOHN C., 1835-1853  
 CRESSON, WILLIAM P., 1848-1849  
 DARRACH, CHARLES G., 1894-1896  
 DAY, CHARLES, 1908-1919  
 DIVINE, WILLIAM, 1864  
 DODGE, KERN, 1916-1920  
 DODGE, JAMES M., 1896-1903  
 DONALDSON, JOSEPH, 1825  
 DOUGHERTY, JAMES, 1858-1861  
 DRAPER, EDMUND, 1847-1850  
 DREER, FERDINAND J., 1862  
 DROWN, WILLIAM A., 1861-1863  
 DU BOIS, WILLIAM L., 1880-1882  
 DURFEE, WILLIAM F., 1872-1873  
 EASTWICK, ANDREW M., 1836-1844  
 EASTWICK, EDWARD P., 1859-1860  
 EBERT, MORRIS, 1908-1911  
 ECKERT, GEORGE M., 1852-1854  
 EGLIN, W. C. L., 1908-  
 EISENHUT, JOHN D., 1824-1825  
 ELDRIDGE, G. MORGAN, 1885-1890  
 ELLIS, JAMES P., 1848-1851  
 EMERSON, G., 1828  
 EREBY, GEORGE, 1854-1866  
 EVANS, OWEN, 1844-1857  
 FARR, GEORGE W., 1851  
 FERGUSON, ALEXANDER, 1831-1841  
 FLETCHER, THOMAS, 1826-1827  
 FLING, WILLIAM B., 1842  
 FORSTALL, WALTON, 1908-  
 FOX, GEORGE, 1828-1830  
 FRALEY, FREDERICK, 1829, 1848-1854  
 FRANKLIN, BENJAMIN, 1917-  
 FRAZER, JOHN F., 1844, 1865-1866  
 FRAZER, PERSIFOR, 1880-1891, 1903-1909  
 FRAZIER, GEORGE H., 1898  
 FRENCH, HOWARD B., 1900  
 FRY, WILLIAM, 1825  
 GARDINER, JOHN, JR., 1864  
 GARRIGUES, ISAAC B., 1825-1829, 1831-  
 1836  
 GARRISON, F. LYNWOOD, 1890-1895, .  
 1897-1903  
 GAWTHROP, HENRY, 1896-1898  
 GIBBS, ALFRED W., 1915-  
 GIBSON, J. HOWARD, 1893-1894  
 GIBSON, JOHN J., 1912-1915  
 GILDER, JOHN, 1838-1841  
 GILPIN, THOMAS, 1824  
 GOBRECHT, CHRISTIAN, 1828-1830  
 GOLDSMITH, E., 1908-1916  
 GRAHAM, HOWARD S., 1920-1921





## MANAGERS—(Continued)

- MCKEAN, WILLIAM V., 1879-1883  
 MARKS, WILLIAM D., 1881-1884  
 MARSHALL, SAMUEL R., 1887-1893  
 MASON, DAVID H., 1824  
 MASON, JAMES S., 1861  
 MEGARGEE, CHARLES, 1858  
 MEIRS, RICHARD WALN, 1908-1917  
 MERRICK, J. VAUGHAN, 1864-1866,  
 1870-1884  
 MERRICK, SAMUEL V., 1824-1827,  
 1830-1841, 1855-1863  
 MIFFLIN, LLOYD, 1825-1826  
 MILES, FREDERICK B., 1874  
 MILLER, ABRAHAM, 1824-1846, 1855-  
 1858  
 MITCHELL, J. E., 1874  
 MITCHELL, WILLIAM A., 1864-1865  
 MORRIS, ISAAC P., 1836-1843  
 MOORE, BLOOMFIELD H., 1864-1868  
 MOORE, JOSEPH W., 1860-1861  
 MORGAN, MARSHALL S., 1914-  
 MORRIS, ELWOOD, 1844-1847  
 MORRIS, HENRY G., 1864-1869  
 MORRIS, WILLIAM E., 1847-1851  
 MUCKLE, M. RICHARDS, JR., 1894-1896  
 NAYLOR, JACOB, 1863, 1865-1872  
 NEAFIE, JACOB G., 1868  
 NEWHALL, PAUL W., 1843-1844  
 NORRIS, ISAAC, 1870-1878, 1883-1918.  
 NYSTROM, JOHN W., 1873-1875  
 OGDEN, JOHN M., 1833  
 OGLE, WILLIAMS, 1845-1850  
 O'NEILL, JOHN, 1827-1832  
 ORR, HECTOR, 1871-1887  
 OUTERBRIDGE, ALEX. E., JR., 1881-1886  
 PALMER, B. FRANKLIN, 1862  
 PARRISH, WILLIAM D., 1838, 1852-  
 1854  
 PARRY, CHARLES T., 1864  
 PATTERSON, ROBERT, 1824  
 PATTERSON, ROBERT M., 1825-1827  
 PAUL, LAWRENCE T., 1895-  
 PEMBERTON, HENRY, JR., 1891-1896  
 PERRY, ROBERT S., 1912-1916  
 PETTIT, HORACE, 1894-1910  
 PURVES, ALEXANDER, 1875-1876  
 RALSTON, ASHBEL G., 1825-1830  
 RAMAGE, ADAM, 1824-1832  
 RAND, THEODORE D., 1874-1897  
 REED, WILLIAM B., 1832-1836  
 REEVES, BENJAMIN, 1829-1837  
 REEVES, SAMUEL J., 1864  
 REEVES, STACY, 1889-1902  
 RICE, JOHN, 1866-1867  
 RICHARDS, MARK, 1831  
 RICHARDSON, JOHN, 1825  
 RIEHLE, HENRY J., 1826-1827  
 ROBBINS, SAMUEL J., 1827-1833  
 ROBERTS, ALGERNON S., 1828  
 ROBERTS, PERCIVAL, 1864-1868  
 ROBERTS, SOLOMON W., 1842-1847  
 ROBINSON, ALEXANDER P., 1911-1916  
 ROGERS, EVANS, 1854-1863  
 ROGERS, HENRY D., 1838-1843  
 ROGERS, JAMES S., 1909-  
 ROGERS, ROBERT E., 1867  
 RONALDSON, CHARLES E., 1885-1893,  
 1908-1912  
 ROSENGARTEN, GEORGE D., 1912-  
 ROWLAND, JAMES, JR., 1829-1830  
 ROWLAND, WILLIAM, 1828  
 RUSH, WILLIAM, 1825  
 RUST, JAMES I., 1824  
 SADTLER, SAMUEL P., 1888-1897  
 SANBORN, E. H., 1907-  
 SARTAIN, JOHN, 1877-1879  
 SARTAIN, SAMUEL, 1865-1882  
 SAVERY, PELEG B., 1851-1852  
 SAXTON, JOSEPH, 1842-1844  
 SAY, BENJAMIN, 1832-1833  
 SCATTERGOOD, THOMAS, 1829-1834  
 SCHAUM, OTTO W., 1907  
 SCHREINER, JOSEPH H., 1827-1832  
 SCHUMANN, FRANCIS, 1899-1902



## PAST CHAIRMEN OF THE 1834-1921 COMMITTEE ON SCIENCE AND THE ARTS

BACHE, ALEXANDER D., 1834-1836, 1839-1844	KOENIG, G. A., 1888-1889
BEARDSLEY, ARTHUR, 1892-1895	LEVY, LOUIS E., 1901-1902
BILGRAM, HUGO, 1906-1907	LEWIS, WILFRED, 1912-1913
BONINE, CHARLES E., 1916-1917	MARBURG, EDGAR, 1899-1900
CHRISTIE, JAMES, 1897-1898	MARKS, W. D., 1881-1882, 1887-1888
CLAMER, G. H., 1915-1916	McCONNELL, JACOB Y., 1909-1910
CONARD, THOMAS P., 1902-1903	ORR, HECTOR, 1880-1881
CREIGHTON, H. JERMAIN, 1918-1919	PATTERSON, R. M., 1836-1839
CRESSON, J. C., 1844-1876	PENROSE, CHARLES, 1920-1921
CRISFIELD, J. A. P., 1913-1914	ROGERS, JAMES S., 1908-1909
ELDRIDGE, G. MORGAN, 1896-1897	RONALDSON, CHARLES E., 1903-1904
FRANKLIN, BENJAMIN, 1919-1920	RONDINELLA, L. F., 1898-1899
GOLDSMITH, EDWARD, 1905-1906	SARTAIN, SAMUEL, 1895-1896
GRIGGS, WILLIAM O., 1907-1908	SELLERS, COLEMAN, 1875-1880
HAUPT, LEWIS M., 1904-1905	SPANGLER, H. W., 1890-1891
HENDERSON, GEORGE R., 1914-1915	SPENCER, THOMAS, 1910-1911
HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901	WETHERILL, WILLIAM C., 1917-1918
HOADLEY, GEORGE A., 1911-1912	WIEGAND, S. LLOYD, 1889-1890, 1891- 1892



Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617; of France since 1791, of Switzerland since 1888, of the United States since 1790. Abstracts of the patents granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from States and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic effort to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 74,668 volumes and 16,597 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing their investigations.

## THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion, as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."



The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE  
FRANKLIN JOURNAL  
AND  
MECHANICS' MAGAZINE,  
Under the Patronage  
of the

FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE  
MECHANIC ARTS. EDITED BY DR. THOMAS P. JONES, PROFESSOR OF  
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States, from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time; 190 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of over 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

### THE SCHOOL OF MECHANIC ARTS

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.





found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

### MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

### EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

## **SOME INSTANCES OF THE INSTITUTE'S WORK**

### **(CHRONOLOGICALLY STATED)**

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1824. It held the first Exhibition of American Manufactures in Carpenters' Hall on October 18, 19, 20. Silver medals were awarded for steel, domestic carpetings, straw and grass bonnets, etc.

Classes were established in Chemistry, Mechanics, Natural History, Architecture, Mathematics, and Drawing.

The first course of lectures commenced April 28 and was held in the Academy Building, Fourth Street near Arch.

1826. In January the first number of *The Franklin Journal* was issued under the editorial management of Dr. Thomas P. Jones, who two years later became Superintendent of the United States Patent Office.

It extended its educational efforts by establishing on April 6th a High School, in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October.

Thirty-four thousand visitors attended the Institute's Third Industrial Exhibition during its four days' progress.

1827. Select Committee on Dry Docks made a lengthy illustrated report, giving costs, methods of operation, etc.

1829. Committee appointed to investigate the efficiency of moving water as a motive power (water wheel experiments).

1830. Committee appointed to inquire into causes of the explosion of steam boilers.

1831. Joint Committee of The Franklin Institute and American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests.

1832. Commission appointed to examine into the resources, including agricultural, of Pennsylvania, an action which led to a Geological Survey of the State.

Notable paper in JOURNAL OF THE FRANKLIN INSTITUTE by Professor Walter R. Johnson on "The Strength of Steam Boilers."

The Secretary of the Treasury of the United States requested a further extension of the Institute's inquiry into the causes of the explosion of steam boilers to include the prevention of steam boiler explosions.

Committee appointed to investigate the strength of materials. This committee devised apparatus of various forms for the testing of metals, steam boilers, building materials, etc.

The Institute was requested by the State Legislature to examine and report upon the then existing system of weights and measures.



to give prompt and full effect to the same. (The beginning of the Second Geological Survey.)

Committee on Conflagrations and Deaths from Petroleum Used in Lamps. A full report. Resolutions were sent to the Governor and Legislature, requesting the appointment of a commission to investigate the subject, determine tests, and to make laws relating to the burning of oils in lamps.

1874. Fiftieth anniversary. Held great industrial exhibition at Thirteenth and Market Streets—the site of the Wanamaker store.

1875. City Councils appropriated money for the expenses of an expert commission to be nominated by The Franklin Institute and to act in conjunction with the Chief Engineer of the Water Department. To this commission was referred the subject of the present and future water supply of Philadelphia.

1876. The Pennsylvania Museum and School of Industrial Art housed and fostered by the Institute.

1882. Report of the Special Committee on the pollution of the Schuylkill River presented its report suggesting the construction of an intercepting sewer along the Eastern banks of the Schuylkill from Manayunk, with an outlet below the densely populated portions of the city.

1883. Special Committee on the prevention of fires in theatres presented an exhaustive report which contained thirty-eight recommendations intended to make places of amusement more safe.

1884. Without Federal or State aid the Institute held the first great International Electrical Exhibition.

The first International Conference of Electricians was held during the progress of the exhibition.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used.

The organization of The American Institute of Electrical Engineers this year resulted from the holding of the Electrical Exhibition and the International Conference of Electricians held under the auspices of the Institute.

1885. Novelties exhibition held in the buildings erected for use of the electrical exhibition.

1887. The Institute organized the Pennsylvania State Weather Service. Voluntary observers made regular reports on the weather conditions of the State. An appropriation was made by the State to cover cost of clerical services and printing. The service was in operation until 1891, when the State discontinued the appropriation.

1890. Joseph M. Wilson's voluminous report on schools, with particular reference to trade schools, appeared in the JOURNAL OF THE FRANKLIN INSTITUTE during the year. (This report served as a basis for the organization of the Drexel Institute.)

1894. Germantown Junction branch of the drawing school established.

1897. A communication from the Board of Health of the City of Philadelphia requested the Institute to appoint a committee to confer with the Board of Health with a view of taking action to abate or modify the smoke nuisance. A full report appeared in the JOURNAL.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

1901. Resolutions passed to promote commerce by the improvement of waterways and approving the creation of the Department of Commerce.

1902. The metric system fully discussed at the monthly meetings. Resolutions passed petitioning the national government to enact such laws as will ensure its proper use.

1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted Free Radio School for men of the selective draft.

# **CHARTER AND BY-LAWS**

## **THE FRANKLIN INSTITUTE**

### **OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS**

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products, by exhibitions and premiums, by a library and by all such measures as they may judge expedient.





SEC. 2. Said Board of Trustees shall be composed of seven (7) members, originally elected by the Board of Managers on its own nomination.

Vacancies, as they occur, shall be filled by election by the Board of Managers from nominations made by the remaining Trustees to a stated meeting of the Board of Managers at least one month prior to the election; the Board of Managers to have the right to reject any nominations not satisfactory to them.

The remaining members of the Board of Trustees, whenever at any time it shall be deemed necessary to do so, shall have power to assign and convey the property held by them, so as to vest the title thereto in themselves and their successors.

SEC. 3. Said Trustees shall have full power and authority, from time to time, to assign, sell and dispose of any property, real and personal, by them held, unless there shall be some direction by the donors to the contrary, and shall have power to convey the same without purchasers being obliged to see to the application of the purchase moneys, when authorized so to do by a vote of two-thirds ( $\frac{2}{3}$ ) of the members present at any regular or special meeting of the Board of Managers; *provided*, that they shall not be obliged to sell or convey unless a majority of their own Board shall also approve.

SEC. 4. Said Trustees shall not be confined to legal investments, but shall have full power to invest in any real property, improvements and alterations, and in any securities, other than shares of stock, or unusual personal obligations, which to them may seem advisable.

SEC. 5. Said Trustees shall have power to appoint agents to act for them, and for the acts of such agents they shall not be personally responsible where they have exercised ordinary prudence in selecting them.

SEC. 6. Said Trustees shall have power to carry into effect any special trusts upon which any property may be held by them. They shall pay out all necessary and proper costs, charges and expenses, and from time to time shall pay over the net income to the Board of Managers, to be applied by them to the uses of the Institute in accordance with the terms of the trusts from which the income is derived.

The principal and interest of all trust funds shall not be liable for debts of the Institute but shall be devoted to its continuance and preservation.

SEC. 7. At the annual meeting of the Board of Managers in each year, said Board of Trustees shall present report of their proceedings and a detailed statement of their receipts and expenditures for the year. An approval of such account shall be final and conclusive, and shall bar any right to demand any other or further accounting.

SEC. 8. The Board of Trustees, at a meeting of the members of the Institute, called after three (3) months' special notice, at which the holders of nine-tenths ( $\frac{9}{10}$ ) of the whole outstanding shares of stock shall vote affirmatively, may convey all property, real and personal, in them vested, to the Institute, free and clear of all trusts; *provided*, that there be no specific trusts violated by such conveyance, and that all the members of said Board, as the same shall then be constituted, shall approve of such conveyance.



surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

SEC. 9. The shares of stock obtained by the Institute by legacies, donations, or forfeiture shall at once be cancelled.

### ARTICLE III.—*Members.*

SECTION 1. The members of the Institute shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and they may be either annual contributors, associate members, life members, permanent members, holders of Second Class stock, honorary or corresponding members.

SEC. 2. The privileges of membership, other than associate membership, in the Institute shall extend only to persons of legal age who are not in arrears and who shall have signed the Charter and By-Laws.

SEC. 3. Annual contributors shall pay yearly dues of Fifteen Dollars; shall be entitled to all of the privileges of the Institute, and shall be eligible to any office or to membership upon any committee.

SEC. 4. Non-resident annual contributors shall pay an entrance fee of Five Dollars and annual dues of Five Dollars.

SEC. 5. Associate members shall be over seventeen and under twenty-five years of age. They shall have the right to attend all meetings of the Institute, use the library, receive the JOURNAL and serve upon committees, but they shall not have the right to vote or to hold office. They shall pay annual dues of Five Dollars. The term of an associate member shall be limited by the age of twenty-five years, after which he shall become an annual contributor with the dues and privileges of that class and he shall be duly notified of the transfer.

SEC. 6. Annual contributors, whether resident, non-resident or associate members, shall be elected by the Board of Managers.

SEC. 7. Honorary and Corresponding Members shall be nominated by the Board of Managers, and shall require for their election four-fifths of the votes of the members present, at any meeting of the Institute at which their nomination may be acted upon. They shall pay no dues.

SEC. 8. Life members, whose membership shall not be transferable, may be elected by the Board of Managers upon the payment of Two Hundred Dollars in any one year.

Non-resident Life members may be elected in the same way upon payment of Seventy-five Dollars in any one year.

SEC. 9. A permanent membership, which may be transferred by will or otherwise, subject to the approval of the Board of Managers, may be granted by the Board of Managers to any one who shall contribute to the Institute for that purpose the sum of One Thousand Dollars in any one year.

SEC. 10. Non-resident members shall be those who reside permanently at a distance not less than twenty-five miles from Philadelphia. Transfers of membership from the resident to non-resident class may be granted by the Board of Managers at its discretion in cases of temporary absence of a member from the city for a period of not less than one year.



One Manager, to be known as the Alumni Manager, shall be elected in January of every third year, beginning in the year 1910, by the Alumni Association of the Institute, to serve for three years. A vacancy in this position shall be filled by election in the same manner for the unexpired term.

The Secretary shall be elected by the Board of Managers at their first stated meeting after the annual election each year.

SEC. 2. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy, nor received from a member in arrears.

SEC. 3. Nominations for the annual election for officers shall be presented in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members in good standing, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall promptly be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 4. On the date of the annual election, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

#### ARTICLE VII.—*President.*

It shall be the duty of the President, or, in his absence, of one of the Vice-Presidents, in order of seniority of election, or, in their absence, of a President to be chosen *pro tempore*, to preside at all meetings of the Institute and of the Board of Managers.

#### ARTICLE VIII.—*Secretary.*

SECTION 1. The Secretary of the Institute shall be a person of scientific attainments. He shall receive such salary as may be fixed by the Board of Managers.

SEC. 2. He shall have general charge and supervision, subject to the Board of Managers of all the work of the Institute, and of its library, museum, laboratories, and property in general.

SEC. 3. He shall keep the minutes of all meetings of the Institute; and shall perform all the duties usually pertaining to the office of secretary.

SEC. 4. He shall be *ex officio* a member of the Board of Managers and of the standing committees of the Institute.



Sec. 2. They shall keep regular minutes of their proceedings which shall be open at all times to inspection by members of the Institute.

Sec. 3. They shall present at the annual meeting of the Institute a report of their proceedings and of the condition of the affairs of the Institute.

Sec. 4. They shall hold stated meetings once a month. They shall elect their own officers, except the chairman who shall be the President of the Institute, or in his absence, as provided for in Article VII and shall be at liberty to make by-laws for their own regulation not inconsistent with the Charter, or with the By-Laws of the Institute. Seven of their members shall constitute a quorum.

Sec. 5. All vacancies in the Board of Managers shall be filled by an election at the next stated meeting of the Institute.

#### ARTICLE XI.—Audits.

The accounts of the Treasurer and Board of Trustees shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

#### ARTICLE XII.—Committees of the Institute.

Section 1. There shall be the following Standing Committees, each to consist of ten members, to be appointed by the President at the first meeting after the annual election, who may be aided in his choice by nominations made at the annual meeting. All members notified of their appointment to any committee, if they do not decline before the next stated meeting, shall be considered members thereof:—

1. On the Library.
2. On the Museum.
3. On Meetings.

Sec. 2. There shall be a Committee on Science and the Arts, consisting of sixty members of the Institute, who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them and to sustain by their labors the scientific character of the Institute.

They shall be elected by the Board of Managers at its stated meeting on the fourth Wednesday of January, twenty members being elected each year to serve for three years.

The Secretary shall report to the Board of Managers at said meeting the number of vacancies on the Committee from any cause, and the names of those whose terms expire that year, together with the record of their attendance at meetings of the Committee, and a brief summary of their participation in the work of the Committee and its sub-committees. Vacancies occurring during any year may be filled by the Committee itself by election of members to serve until the following January.

Within one month after the Annual Election, the Committee shall hold a meeting at which it shall elect a Chairman for the current year.

It shall be the duty of the Committee to investigate and report upon any





They shall be governed by such rules, not inconsistent with these By-Laws, as may be adopted by them respectively.

The Committees on the Library, on Meetings, and on Science and the Arts, shall meet at least once in each month, except in July and August.

SEC. 4. No bills for expenses incurred by committees shall be paid unless approved by the Committees which incurred them.

#### ARTICLE XIII.—*Meetings.*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

#### ARTICLE XIV.—*Order of Business.*

SECTION 1. The stated meetings of the Institute shall be held at the hour of 8 o'clock P.M.

SEC. 2. The order shall be as follows:

1. Reading of the Minutes.
2. Reports from the Board of Managers.
3. Reports from the Standing Committees, etc.
  - (1) On the Library.
  - (2) On the Museum.
  - (3) On Meetings.
  - (4) On Science and the Arts.
4. Reports from Special Committees.
5. The paper announced for the evening.
6. The Secretary's report.
7. Deferred business.
8. Consideration of new business.

SEC. 3. At the annual meeting, the tellers' report may be received and read by the Secretary immediately after the conclusion of any number of the order of business.

SEC. 4. The order of business may be altered for any meeting by a vote of two thirds of the members present thereat.

#### ARTICLE XV.—*Rules.*

The Institute, at its meetings, shall be governed by Roberts' Rules of Order.

#### ARTICLE XVI.—*Organization and Government of Sections.*

SECTION 1. For the promotion and encouragement of manufactures and the mechanic arts, as well as of the sciences connected with them, members of the Institute may form sections and hold meetings in such rooms as may be provided for them by the Board of Managers. These sections shall be



SEC. 9. Each section shall determine, subject to the approval of the Board of Managers, the times of its stated meetings.

SEC. 10. Papers read and lectures delivered before any section and approved by the same, shall be referred to the Committee on Publications of the Institute, and if accepted by them, shall be published in the JOURNAL of the Institute.

SEC. 11. Societies now existing, or which may hereafter be founded, for the consideration of any subjects clearly within the scope of The Franklin Institute, and which societies may desire to unite with The Franklin Institute as sections, shall furnish a list of such of their members as have declared their willingness to become members of the Institute, to the Committee on Sectional Arrangements, which committee shall transmit the same, with its recommendation, to the Board of Managers.

SEC. 12. On all points not herein provided for, each section shall be governed by the Charter, By-Laws and usages of the Institute.

#### ARTICLE XVII.—*Amendments.*

Proposals for amendments to these By-Laws shall be presented in writing, signed by two members in good standing, at any stated meeting of the Institute. By a majority vote of the members present at this meeting they may be considered, amended, referred, postponed, rejected, or ordered to be voted upon at the date of the next stated meeting, until which time they shall be posted at the Institute. The final vote upon amendments shall be by ballot, and if two-thirds of the votes cast are in favor of any proposed amendment, it shall be declared adopted; except that amendments to Article II, relating to capital stock, must (subsequently) be ratified by a majority of the stock represented at a meeting specially called for this purpose.

### BY-LAWS OF THE BOARD OF MANAGERS

(*As Amended June 8, 1910.*)

SECTION 1. *Officers.*—The President of the Institute, or, in his absence, the Vice-President, in order of seniority of election, or in the absence of both, a member elected *pro tempore*, shall preside at all meetings of the Board. Records of its proceedings shall be kept by the Actuary.

SEC. 2. *Meetings.*—The Board shall hold a meeting for the purpose of organizing, electing a Secretary, and a Committee on Science and the Arts; and appointing an Actuary, Standing Committees, etc., on the fourth Wednesday in January, and regular meetings on the second Wednesday of each month, at 3.30 o'clock P.M.

SEC. 3. Special meetings may be called by the President at his discretion, and shall be called on written request of five members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Actuary.

SEC. 4. *Actuary.*—An Actuary shall be appointed by the Board at their first meeting after the annual election. He shall keep a correct record of



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4. Report from Standing Committees, and action thereon
  - (a) On Instruction.
  - (b) On Election and Resignation of Members.
  - (c) On Stocks and Finance.
  - (d) On Publications.
  - (e) On Exhibitions.
  - (f) On Sectional Arrangements.
  - (g) On Endowment.
  - (h) Executive.
5. Reports from Special Committees and action thereon.
6. Deferred Business.
7. New Business.

SEC. 10. *Amendments.*—These By-Laws may be altered at any stated meeting of the Board, provided the alteration be approved by two-thirds of the members present.





event of an accumulation of the fund for medals beyond the one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some work on any mechanical or scientific subject that is considered of special importance.

**The Certificate of Merit.**—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

**The Boyden Premium** (Premium of \$1000).—To any resident of America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

### HISTORY OF THE MEDALS.

**The Franklin Medal.**—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stating that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to applications of physical science to industry, rather than in recognition of a single invention or discovery, however important. He agreed to contribute for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate design and dies for the medal and diploma.
2. That the medal should possess distinct artistic merit and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.
3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.
4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).
5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its application.
6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award on the average, two Franklin Medals a year. Though this would leave a surplus he inserted the sixth condition to prevent an undesirable accumulation of the fund.



4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,  
*President.*

[SEAL]

R. B. OWENS,  
*Secretary.*

**The Elliott Cresson Medal.**—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and



1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

**The Certificate of Merit.**—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

*"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:*

*'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to \_\_\_\_\_ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.*

Report No. \_\_\_\_\_ Approved, ———— 19 \_\_\_\_\_

\_\_\_\_\_ —President.

[SEAL.]

\_\_\_\_\_ —Secretary.

*Chairman of the Committee on Science and the Arts.'*"

**The Boyden Premium.**—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

*"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of  $2 \times 10^{14}$  double vibrations per second in the infra-red and  $8 \times 10^{14}$  in the ultra-violet, travel through free space with the same velocity."*

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.



4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

### ARTICLE III.—*Chairman.*

SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees on investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

### ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The





**SEC. 6.** When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

**SEC. 7.** Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

**SEC. 8.** Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

**SEC. 9.** Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

**SEC. 10.** Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

**SEC. 11.** Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

**SEC. 12.** Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

**SEC. 13.** When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

#### **ARTICLE VI.—*Sub-Committee Meetings.***

**SECTION 1.** A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

**SEC. 2.** No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

#### **ARTICLE VII.—*Sub-Committees' Reports.***

**SECTION 1.** Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B.



**SEC. 12.** Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

**ARTICLE VIII.—*Notices of Recommendations.***

**SECTION 1.** In the case of investigations made upon application, it shall be the duty of the Secretary to certify to applicants the recommendations of the sub-committee within ten days after this recommendation is adopted by the Committee.

**ARTICLE IX.—*Reconsideration.***

**SECTION 1.** Upon the adoption of a report of a sub-committee a motion for reconsideration may not be made before the stated meeting following. If such a motion is then made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report previously adopted.

**SEC. 2.** A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

**ARTICLE X.—*Advertisement of Recommendations.***

**SECTION 1.** Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement, or manufacture.

**SEC. 2.** Upon the adoption by the Committee on Science and the Arts of a report of a sub-committee on investigation setting forth that distinguished work in science or the arts is worthy of an award of the Howard N. Meyer Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person who has done such work shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit in the supposed distinguished work in science and the arts.

**SEC. 3.** The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal shall be conclusive without advertisement.



1. That the Certificate of Merit be awarded for meritorious inventions, physical processes, and JOURNAL contributions of substantial merit, but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

#### REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

##### FORM A

(Application for Investigation)

#### THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled .....

..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B  
(Sub-committee Report Form)  
THE FRANKLIN INSTITUTE  
OF THE  
STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....

Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... your sub-committee recommends

the award of ..... to ..... of .....

Respectfully submitted,

..... Chairman.

.....  
.....  
.....

Adopted at the Stated Meeting of ..... 19 .....

YEAR BOOK OF

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia, .....

S. & A. Case No. ....

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....  
..... reports as follows:

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or .

of .....the Institute awards the .....

.....

to..... of .....

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned .....

*Chairman of the Committee on Science and the Arts.*





flourishes little. At the close of the year covered by the report we were a little over hundred eighty strong, and in what must be regarded as an otherwise very satisfactory Institute year, our net membership was reduced by seven. Never in the fifteen years of my experience as an executive had we better attended lectures, or more satisfactory results from our educational efforts, nor did our important Publications Committee do more valuable work; and certainly our financial situation never showed greater improvement than during the twelve months under consideration. Yet, with all this high achievement and prosperity, and in spite of the best efforts of the Committee on Membership, we did not quite hold our own in numbers. This is about the customary condition as of recent years. I think we can anticipate that the people of Philadelphia will not awake to the advantages of membership in The Franklin Institute, or to the importance of the service it is rendering, until the existence of the Institute is more forcibly forced upon their notice, as it will be when our activities are carried on in a more prominent location.

The Committee on Publications, Mr. Rosengarten, Chairman, reports the year's activities at a regrettable but unavoidable increase in cost. We say "regrettable" because we regard it fixed that the high character of the Institute shall be maintained at whatever cost. Certainly this year we are glad to meet the expense incident to maintaining this standard.

The Publications Committee embarked during the year upon an important enterprise, in a sense new to the Institute. With the approval of the Board of Managers, the Committee has published in book form Dr. W. J. Humphreys' great work—"The Physics of the Air." This work is based upon a series of articles appearing in the JOURNAL during the past three years. It is believed to be the most important contribution in the branch of physics of which it treats that ever has been made to the literature of the world. It is the first publication of its kind gotten out by the Institute; and, regarded either as a contribution to the knowledge of the world, or as an example of the printers' and binders' art, it sets a high standard—the standard we strive for and like to think is achieved in the work of the Institute in whatever department.

The Committee on Sectional Arrangements, Dr. Keller, Chairman, reports a series of successful meetings of the sections, with nineteen lectures, each by a lecturer distinguished in his branch of science. These lectures were well attended—mainly by people learned in the art or science discussed. The character of our audiences—largely specialists, teachers and students in the science under discussion, is indicative of the service these lectures are rendering to the mechanic arts as practiced and to artisans as practicing in Philadelphia.

The Committee on Science and the Arts, Mr. Penrose, Chairman, reports twenty-two cases investigated and finished during the year, and seventeen cases pending at the close of the year. This bare statement is far from telling the full story of the activities of the Science and Arts Committee.

We here interrupt the natural course of this report to say that the Board of Managers hope that the members of the Institute will read the full report



fluctuates little. At the close of the year covered by the report we were thirteen hundred eighty strong, and in what must be regarded as an otherwise very satisfactory Institute year, our net membership was reduced by sixteen. Never in the fifteen years of my experience as an executive had we better or better attended lectures, or more satisfactory results from our educational efforts, nor did our important Publications Committee do more notable work; and certainly our financial situation never showed greater improvement than during the twelve months under consideration. Yet, with this record of high achievement and prosperity, and in spite of the best efforts of the Committee on Membership, we did not quite hold our own in numbers. This is about the customary condition as of recent years. I think we may anticipate that the people of Philadelphia will not awake to the advantages of membership in The Franklin Institute, or to the importance of the service it is rendering, until the existence of the Institute is more frequently forced upon their notice, as it will be when our activities are housed in a more prominent location.

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We here interrupt the natural course of this report to say that the Board of Managers hope that the members of the Institute will read the full report



Coleman Sellers, Jr., Vice-President of the Institute.

C. C. Tutwiler, Member of the Board.

Arthur L. Day, Ph.D., Director of Geophysical Laboratory, Carnegie Institution, Washington, D. C.

Joseph S. Ames, Ph.D., LL.D., Director of Physical Laboratory, Johns Hopkins University, Baltimore, Md.

The President and Secretary of the Institute—*ex officio*. The appointed members have accepted the duty imposed, and the Committee will meet in the near future.

The report of the Committee on Stocks and Finance, Mr. Forstall, Chairman, presents a statement of receipts and expenditures for the year that should prove interesting and gratifying to each member and friend of the Institute. Its closing paragraph contains the statement that during the year there was an increase in the balance of assets over liabilities of \$51,974.54. We may not reasonably expect each year to show an increase in this balance, but, if we may judge the future by the past—if we may expect the character of our work to commend itself in the future as in the past it has commended itself to people seeking to dedicate their savings to a public good, we may safely count on such support as will insure through the coming decades the maintenance of the Institute and its activities, however any single year's balance sheet may disappoint us.

In the past we have had years lean indeed. Today we may be said to prosper. Because we have believed that such work as we could perform would find, over a period of years, ample financial support, we have had faith to carry on our work at times when to carry on meant living on our accumulated funds or going into debt, or both. But never have we so ordered our affairs as to render in any degree precarious the claims of those to whom we might become financially indebted. It has been the policy of your Board to do the work for which your Institute was created as long as there were available funds or saleable property or bank credit; never to the extent of placing creditors in peril or of using trust funds other than as designed by their owners, but otherwise to the limit of possibility. We believed that such a course would commend itself to people with savings to devote to a public good, and that our work would be supported. And the event has proven the wisdom of the course. Our work has been supported. The fears of any who may have had contrary opinions have not been justified. People seeking to invest their money for a public good have looked with favor upon your Institute as an instrument. Funds have come to us. In the face of the enormous increase in the recent cost of doing any kind of work the Institute has carried on its work undiminished. The funds that in recent times have come to us have supported us in our activities, and have greatly increased our endowments in addition to paying the debts incurred in the lean years—years when, poor in money but rich in faith, the membership endorsed our policies and shared our responsibilities. This current year, 1921, the Institute will be out of debt, other than the debt of one department to another. It is a condition none of us can remember as previously existing in the affairs of the Institute. The funds that have come to us from gifts

or bequests have mostly been dedicated to endowment rather than for operating costs. So, although our funds had previously increased much more than sufficiently to pay the debts incurred in our lean years, it is only this past year that our funds applicable to operating have been sufficient for the cancellation of our debts.

As written above, we may not expect each year to be so free as now from financial anxieties. But, as over a period of years, we have no doubt that as we maintain the Institute's activities in accord with the traditions that have been growing for nearly a century in this old building, we will be given the means necessary to their indefinite continuance. This has proven true of four generations of men. With a full appreciation of their quality, let us strengthen our resolution that for the fraction of the Institute's life in which its affairs are in our custody these affairs shall be so ordered that they who follow us may judge us to have been not altogether unworthy successors of the notable men once workers within these walls now long gone to their reward. Thus only can we be justified in accepting the trust of the generous men and women who, seeking the promotion of the mechanic arts, have chosen The Franklin Institute to be the almoner of their bounty.

Respectfully submitted,

By order of the Board of Managers,

WALTON CLARK,

*President.*

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON LIBRARY.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

[ABSTRACT.]

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of the activities in the library during the year ending September 30, 1920:

The additions to the library were as follows:

Source	Bd. Vols.	Unbd. Vols.	Pgts	Photographs	Maps
By Gift .....	208	275	1373	9	1
Binding .....	227				
JOURNAL .....	32	21			1
Purchase:					
Books and Periodicals					
Acc't. ....	8	1			
Lea Fund .....	68	23			1
Memorial Library Fund.	2				
Miscellaneous Expense					
Acc't. ....			2		
Moore Fund .....	109	9	3		
Morris Fund .....	24	2			
Potts Fund .....	18				
Ware Fund .....	1				
	787	331	1378	9	3

Total additions for the year .....2508  
an increase of 379 titles over the previous year.

The Committee had at its disposal \$2890.00. appropriated by the Board of Managers and \$3900.32 being the income of the various trust funds.

The expenditures for the year were \$1601.91 for subscriptions to magazines and other periodical publications, \$768.75 for binding, \$2023.06 for books and \$107.61 for general expenses.

Donors:

Gifts of books, pamphlets and magazines in large quantities or of special value were given by Messrs. H. M. B. Bary, J. T. Butler, Charles E. Duryea, W. Copeland Furber, F. Lynwood Garrison, Henry Howson, Howard S. Levy, J. H. Mulligan, Lawrence T. Paul, Dr. Paul J. Sartain, Mrs. H. B. Hackett, Messrs. Harris and Richards, Mrs. E. H. Kanitz of New York City and the Shoemaker-Satterthwaite Bridge Company.

Dr. Edward G. Acheson presented the library with a year's subscription to *Forbes' Magazine* and Mr. Henry Howson, in addition to a gift of about 1000 volumes, presented a desk which has been placed in the reading room.

The contents of the library on September 30, 1920, were as follows:

Volumes, bound and unbound ..... 74.668





1. That the Certificate of Merit be awarded for meritorious inventions, physical processes, and JOURNAL contributions of substantial merit, but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

#### **REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS**

##### **FORM A**

(Application for Investigation)

#### **THE FRANKLIN INSTITUTE**

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled .....

..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B  
(Sub-committee Report Form)  
THE FRANKLIN INSTITUTE  
OF THE  
STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....

Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... your sub-committee recommends  
the award of ..... to ..... of .....

Respectfully submitted,

..... Chairman.

.....

.....

.....

Adopted at the Stated Meeting of ..... 19 .....

## YEAR BOOK OF

## FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia, .....

S. &amp; A. Case No. ....

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....  
..... reports as follows:

.....

In consideration of the {  
discovery  
excellence of construction  
ingenuity and novelty  
or

of .....the Institute awards the .....

.....

to..... of .....

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned .....

*Chairman of the Committee on Science and the Arts.*



fluctuates little. At the close of the year covered by the report we were thirteen hundred eighty strong, and in what must be regarded as an otherwise very satisfactory Institute year, our net membership was reduced by sixteen. Never in the fifteen years of my experience as an executive had we better or better attended lectures, or more satisfactory results from our educational efforts, nor did our important Publications Committee do more notable work; and certainly our financial situation never showed greater improvement than during the twelve months under consideration. Yet, with this record of high achievement and prosperity, and in spite of the best efforts of the Committee on Membership, we did not quite hold our own in numbers. This is about the customary condition as of recent years. I think we may anticipate that the people of Philadelphia will not awake to the advantages of membership in The Franklin Institute, or to the importance of the service it is rendering, until the existence of the Institute is more frequently forced upon their notice, as it will be when our activities are housed in a more prominent location.

The Committee on Publications, Mr. Rosengarten, Chairman, reports the usual activities at a regrettable but unavoidable increase in cost. We say "unavoidable" because we regard it fixed that the high character of the JOURNAL shall be maintained at whatever cost. Certainly this year we are able to meet the expense incident to maintaining this standard.

The Publications Committee embarked during the year upon an important enterprise, in a sense new to the Institute. With the approval of the Board of Managers, the Committee has published in book form Dr. W. J. Humphreys' great work—"The Physics of the Air." This work is based upon a series of articles appearing in the JOURNAL during the past three years. It is believed to be the most important contribution in the branch of physics of which it treats that ever has been made to the literature of the world. It is the first publication of its kind gotten out by the Institute; and, regarded either as a contribution to the knowledge of the world, or as an example of the printers' and binders' art, it sets a high standard—the standard we strive for and like to think is achieved in the work of the Institute in whatever department.

The Committee on Sectional Arrangements, Dr. Keller, Chairman, reports a series of successful meetings of the sections, with nineteen lectures, each by a lecturer distinguished in his branch of science. These lectures were well attended—mainly by people learned in the art or science discussed. The character of our audiences—largely specialists, teachers and students in the art or science under discussion, is indicative of the service these lectures are rendering to the mechanic arts as practiced and to artisans as practicing in Philadelphia.

The Committee on Science and the Arts, Mr Penrose, Chairman, reports twenty-two cases investigated and finished during the year, and seventeen cases pending at the close of the year. This bare statement is far from carrying the full story of the activities of the Science and Arts Committee.

We here interrupt the natural course of this report to say that the Board of Managers hope that the members of the Institute will read the full report



Coleman Sellers, Jr., Vice-President of the Institute.

C. C. Tutwiler, Member of the Board.

Arthur L. Day, Ph.D., Director of Geophysical Laboratory, Carnegie Institution, Washington, D. C.

Joseph S. Ames, Ph.D., LL.D., Director of Physical Laboratory, Johns Hopkins University, Baltimore, Md.

The President and Secretary of the Institute—*ex officio*. The appointed members have accepted the duty imposed, and the Committee will meet in the near future.

The report of the Committee on Stocks and Finance, Mr. Forstall, Chairman, presents a statement of receipts and expenditures for the year that should prove interesting and gratifying to each member and friend of the Institute. Its closing paragraph contains the statement that during the year there was an increase in the balance of assets over liabilities of \$51,974.54. We may not reasonably expect each year to show an increase in this balance, but, if we may judge the future by the past—if we may expect the character of our work to commend itself in the future as in the past it has commended itself to people seeking to dedicate their savings to a public good, we may safely count on such support as will insure through the coming decades the maintenance of the Institute and its activities, however any single year's balance sheet may disappoint us.

In the past we have had years lean indeed. Today we may be said to prosper. Because we have believed that such work as we could perform would find, over a period of years, ample financial support, we have had faith to carry on our work at times when to carry on meant living on our accumulated funds or going into debt, or both. But never have we so ordered our affairs as to render in any degree precarious the claims of those to whom we might become financially indebted. It has been the policy of your Board to do the work for which your Institute was created as long as there were available funds or saleable property or bank credit; never to the extent of placing creditors in peril or of using trust funds other than as designed by their owners, but otherwise to the limit of possibility. We believed that such a course would commend itself to people with savings to devote to a public good, and that our work would be supported. And the event has proven the wisdom of the course. Our work has been supported. The fears of any who may have had contrary opinions have not been justified. People seeking to invest their money for a public good have looked with favor upon your Institute as an instrument. Funds have come to us. In the face of the enormous increase in the recent cost of doing any kind of work the Institute has carried on its work undiminished. The funds that in recent times have come to us have supported us in our activities, and have greatly increased our endowments in addition to paying the debts incurred in the lean years—years when, poor in money but rich in faith, the membership endorsed our policies and shared our responsibilities. This current year, 1921, the Institute will be out of debt, other than the debt of one department to another. It is a condition none of us can remember as previously existing in the affairs of the Institute. The funds that have come to us from gifts

or bequests have mostly been dedicated to endowment rather than for operating costs. So, although our funds had previously increased much more than sufficiently to pay the debts incurred in our lean years, it is only this past year that our funds applicable to operating have been sufficient for the cancellation of our debts.

As written above, we may not expect each year to be so free as now from financial anxieties. But, as over a period of years, we have no doubt that as we maintain the Institute's activities in accord with the traditions that have been growing for nearly a century in this old building, we will be given the means necessary to their indefinite continuance. This has proven true of four generations of men. With a full appreciation of their quality, let us strengthen our resolution that for the fraction of the Institute's life in which its affairs are in our custody these affairs shall be so ordered that they who follow us may judge us to have been not altogether unworthy successors of the notable men once workers within these walls now long gone to their reward. Thus only can we be justified in accepting the trust of the generous men and women who, seeking the promotion of the mechanic arts, have chosen The Franklin Institute to be the almoner of their bounty.

Respectfully submitted,

By order of the Board of Managers,

WALTON CLARK,

*President.*

PHILADELPHIA, January 12, 1921.



REPORT OF THE COMMITTEE ON LIBRARY.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

[ABSTRACT.]

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of the activities in the library during the year ending September 30, 1920:

The additions to the library were as follows:

Source		Bd. Vols.	Unbd. Vols.	Pphs.	Photographs	Maps
By Gift	.....	298	275	1373	9	1
Binding	.....	227				
JOURNAL	.....	32	21			1
Purchase:						
Books and Periodicals						
Acc't.	.....	8	1			
Lea Fund	.....	68	23			1
Memorial Library Fund.		2				
Miscellaneous Expense						
Acc't.	.....			2		
Moore Fund	.....	109	9	3		
Morris Fund	.....	24	2			
Potts Fund	.....	18				
Ware Fund	.....	1				
		787	331	1378	9	3

Total additions for the year .....2508  
an increase of 379 titles over the previous year.

The Committee had at its disposal \$2890.00, appropriated by the Board of Managers and \$3900.32 being the income of the various trust funds.

The expenditures for the year were \$1601.91 for subscriptions to magazines and other periodical publications, \$768.75 for binding, \$2023.06 for books and \$107.61 for general expenses.

Donors:

Gifts of books, pamphlets and magazines in large quantities or of special value were given by Messrs. H. M. B. Bary, J. T. Butler, Charles E. Duryea, W. Copeland Furber, F. Lynwood Garrison, Henry Howson, Howard S. Levy, J. H. Mulligan, Lawrence T. Paul, Dr. Paul J. Sartain, Mrs. H. B. Hackett, Messrs. Harris and Richards, Mrs. E. H. Kanitz of New York City and the Shoemaker-Satterthwaite Bridge Company.

Dr. Edward G. Acheson presented the library with a year's subscription to *Forbes' Magazine* and Mr. Henry Howson, in addition to a gift of about 1000 volumes, presented a desk which has been placed in the reading room.

The contents of the library on September 30, 1920, were as follows:

Volumes, bound and unbound ..... 74,668



the Institute's School of Mechanic Arts.

Air pump, formerly the property of Dr. Joseph Priestley, presented to the Institute by Mr. Coleman Sellers, Jr., and Mr. Horace Wells Sellers.

Ruling machine for engravers, camera obscura and camera used by Mr. John Sartain, artist, and Mr Samuel Sartain, former Treasurer of the Institute. Presented by Dr. Paul J. Sartain.

Daguerreotype of Matthias W. Baldwin. Presented by Mrs. I. W. Morris.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,  
*Chairman.*

PHILADELPHIA, January 12, 1921.

## REPORT OF THE COMMITTEE ON MEETINGS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

*To the President and Members of The Franklin Institute:*

Eight stated meetings were held during the year ending September 30, 1920. These were held on the third Wednesday of each month at the hour of eight o'clock with the exception of that of May 19th, which was held at four o'clock in the afternoon. The following is a list of the speakers with the titles of their communications:

October 15, 1919: Captain S. W. Bryant, Acting Director, Naval Communication Service, "The U. S. Naval Communication Service."

November 19, 1919: Rear Admiral J. A. Hoogewerff, U. S. Navy, Superintendent of the U. S. Naval Observatory, "The Relation of the U. S. Naval Observatory to the Navy and Shipping Interests of the Country."

December 17, 1919: Brigadier General R C. Marshall, Jr., U. S. A., Chief of the Construction Division, War Department, "The Construction Division of the Army."

January 21, 1920: Dr J. C. Hunsaker, Commander Construction Corps, U. S. N., "U. S. Naval Aircraft."

February 18, 1920: Dr. Irving Langmuir, Research Laboratory, General Electric Company, "The Structure of Atoms and its Bearing on Chemical Valance."

March 17, 1920: Mr. G. H. Clamer, "The Induction Electrical Furnace."

April 21, 1920: Rear Admiral David Watson Taylor, Chief Constructor U. S. N., Chief of Bureau of Construction and Repair, Navy Department, "The Design of War Vessels as Affected by the World War."

May 19, 1920: Presentation of the Franklin Medal to His Excellency Sir Auckland Geddes, British Ambassador, on behalf of His Britannic



First-Year Mechanical Drawing. Marked interest was also shown in the course in Naval Architecture.

Unusual interest in their work was manifested by all of the students, and the high averages in attendance and class work indicate that the School of Mechanic Arts has completed one of its most successful years. For the first term ninety-four students had a perfect attendance record, and sixty-one had a perfect attendance record during the second term. In the regular school work, fifty-one students made an average of 90 per cent. or over during the first term, and forty-three an average of 90 per cent. or over during the second term.

The Faculty for the year was as follows:

Mr. Arthur J. Stretton, The Baldwin Locomotive Works, Mechanical Drawing.

Mr. I. P. Pedrick, William Sellers & Co., Inc., Mechanical Drawing.

Mr. G. W. H. Fawkes, of the University of Pennsylvania Faculty, Mechanical Drawing.

Mr. H. W. Howitz, The Baldwin Locomotive Works, Mechanical Drawing.

Mr. Clement Remington, Associated with Horace Trumbauer, Architect, Architectural Drawing.

Mr. John C. Bechtel, Germantown High School, Mathematics.

Mr. Howard S. Eitzel, Friends' Central High School, Mathematics.

Mr. K. E. DeRosay, of the University of Pennsylvania Faculty, Mathematics.

Mr. H. H. Fox, Norristown High School, Mathematics.

Mr. P. J. Brady, Philadelphia Electric Company, Mathematics.

Mr. Bartram A. Owen, of the University of Pennsylvania Faculty, Mechanics.

Mr. Joseph W. Thompson, New York Shipbuilding Company, Naval Architecture.

Mr. B. B. Wood, William Cramp & Sons' Ship and Engine Building Company, Naval Architecture.

Mr. Albert R. Ware, New York Shipbuilding Company, Naval Architecture.

Mr. H. Earl Barrett, William Cramp & Sons' Ship and Engine Building Company, Naval Architecture.

Mr. James G. Morgan, New York Shipbuilding Company, Naval Architecture.

During the year, students of the School, in company with members of the Alumni Association, visited the following places of engineering interest:

New York Shipbuilding Company, Camden, N. J.

The Broad Street Subway under City Hall, Philadelphia, Pa.

U. S. Army Supply Base, Greenwich Point, Philadelphia.

Hog Island Shipyard, Hog Island, Philadelphia.

In every case the attendance was good and much interest was shown by those present. Thanks are due to the managements represented for their courtesy and to the Alumni Association upon whose invitation the students made these visits.



Rogers, Colonel in American Expeditionary Forces.

During the summer the School Calendar was published, 3000 copies of which and 1000 posters were distributed in such a way as seemed likely to reach the greatest number of possible students.

Respectfully submitted,

LAWRENCE T. PAUL,  
*Chairman.*

PHILADELPHIA, January 12, 1921.

**REPORT OF THE COMMITTEE ON ELECTION AND  
RESIGNATION OF MEMBERS**

**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.**

*To the Board of Managers of The Franklin Institute:*

During the fiscal year ending September 30, 1920, sixty-seven new members were enrolled in all classes of membership; resignations were received and accepted from thirty-three members; and deaths of twenty-three members were recorded.

The detail as to elections, resignations, and deaths for the three years ending September 30, 1920, is as follows:

**ELECTIONS:**

	1917-18	1918-19	1919-20
Resident Members .....	15	21	32
Non-Resident Members .....	17	28	19
Associate Members .....	7	4	11
Honorary Members .....	0	10	2
Corresponding Members .....	0	0	3
Life Members .....	5	3	0
Second-Class Stock .....	1	0	0
	—	—	—
	45	66	67

**RESIGNATIONS:**

Resident Members .....	16	17	19
Non-Resident Members .....	13	10	14
Associate Members .....	1	0	0
Second Class Stock .....	0	0	0
	—	—	—
	30	27	33

**DEATHS:**

Resident Members .....	5	8	6
Non-Resident Members .....	7	12	8
Life Members .....	5	11	8
Honorary Members .....	0	1	1
Associate Members .....	0	2	0

	1917-18	1918-19	1919-20
Second Class Stock .....	0	1	0
	—	—	—
	17	35	23
SUMMARY:			
Elections .....	45	66	67
Resignations .....	30	27	33
Dropped for non-payment of dues .....	10	10	27
Deaths .....	17	35	23
Net decrease in membership.....		16	

Members of the Institute by Classes, September 30, 1920:

Resident Members .....	488
Non-Resident Members .....	589
Life Members .....	218
Honorary Members .....	24
Associate Members .....	32
Second Class Stock .....	25
Corresponding Members .....	4
<hr/>	
Total .....	1380

It will be noted that a large part of the decrease in membership is due to the dropping of members for non-payment of dues. During the war the stringent enforcement of rules against the members for non-payment of dues was not pressed, but since the conclusion of hostilities and the return of normal business conditions action in this direction has been taken by the Secretary, with the result as shown in the report. It is hoped that during the coming year an increase of membership may be obtained, and the individual personal solicitation of our membership is requested to aid the Committee in this direction.

Respectfully submitted,

R. W. LESLEY,  
Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON STOCKS AND  
FINANCE.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

The Committee presents the following financial statement:

PROPERTY AND FUNDS.

Building and land, 13-17 South Seventh Street.....	\$60,000.00	
Library .....	100,000.00	\$160,000.00
	<hr/>	



	Principal	Unexpended Income	
Fund held by Board of Trustees.....	\$642,001.51	\$2,822.03	
Funds held by Board of Managers.....	146.39		
Franklin Institute Building Fund.....	499,156.30		
Elliott Cresson Medal Fund.....	3,000.00	598.86	
Franklin Fund and Building Committee.	14,384.50		
	<hr/>	<hr/>	
Total Funds .....	\$1,146,690.70	\$3,420.89	1,150,111.89
			<hr/>
Grand Total .....			\$1,310,111.59

## LIABILITIES.

Certificates of Stock .....	\$29,440.00
Mortgage on Institute Building (held by Trustees as investment for Fund) .....	21,250.00
Bills Payable .....	31,000.00
Vouchers Payable .....	4,777.20
Unearned Income .....	6,467.20
	<hr/>
Grand Total .....	\$92,934.40

## INCOME AND EXPENSES APPLICABLE TO YEAR ENDED SEPTEMBER 30, 1920.

*Income.*

Dues .....	\$10,695.00
Initiation Fees .....	110.00
H. Belfield Memorial Fund .....	268.82
James H. Cresson Memorial Fund .....	2,267.92
General Endowment Fund .....	19,480.03
John H. Wahl Fund .....	4,141.20
Estate of John Turner .....	139.18
Estate of Robert Wright .....	1,730.31
Instruction: Drawing.....	\$2,080.00
Mathematics .....	1,826.00
Mechanics .....	323.00
Naval Architecture .....	937.50
	<hr/>
Publications: Subscriptions and Sales .....	\$2,582.21
Advertising .....	2,493.47
	<hr/>
	\$49,074.64

## EXPENSES.

Building: Wages .....	\$1,727.70
Repairs and Maintenance .....	222.11
Taxes, Water Rent and Insurance .....	536.23
Heat, Light and Power.....	1,126.13
Miscellaneous Supplies and Expense.....	476.34
	<hr/>

Instruction: Drawing .....	\$1,159.50	
Mathematics .....	1,072.50	
Mechanics .....	224.00	
Naval Architecture .....	840.00	
Salaries and Annuities .....	1,443.28	
Miscellaneous Expense .....	702.75	5,442.03
<hr/>		
Library: Salaries .....	\$6,754.43	
Books and Periodicals .....	1,601.91	
Binding .....	768.75	
Miscellaneous Expense .....	107.61	9,232.70
<hr/>		
Meetings .....		832.28
Office and General: Salaries .....	\$11,649.69	
Office Expense .....	1,219.28	
General Expense .....	1,246.75	
Auditor and Treasurer .....	848.49	14,964.21
<hr/>		
Publications: Printing .....	\$12,234.38	
Reprints .....	181.84	
Illustrating .....	2,341.74	
Miscellaneous Expense .....	426.16	
Year Book .....	728.97	15,913.09
<hr/>		
Science and Arts .....		3,907.67
Sections .....		1,858.28
University of Louvain Gift .....		296.57
Interest and Discount .....		1,845.06
Badges and Certificates .....		77.30
Miscellaneous Income and Expense .....		275.46
		<hr/>
		\$58,733.16
		<hr/>
Deficit .....		\$9,658.52

The deficit as given in the foregoing is in operating expenses only, because during the year the increase in assets over liabilities has been \$51,947.54.

Respectfully submitted,

WALTON FORSTALL,

*Chairman.*

PHILADELPHIA, January 12, 1921.

## REPORT OF THE COMMITTEE ON PUBLICATIONS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

*To the Board of Managers of The Franklin Institute:*

The two principal publications of the Institute, the monthly JOURNAL of its proceedings and the Year Book, have been published as usual. The JOURNAL is supplied to the membership of the Institute and copies are exchanged with similar publications of other institutions and with scientific and technical Journals. They are also kept on file in Scientific Libraries. To meet this demand 2625 copies have been printed each month throughout the year. The Year Book is also supplied to the membership and distributed to the leading scientific societies throughout the world, this requiring the publication of 2000 copies.

Many of the lectures delivered in The Franklin Institute course of Lectures were printed in the JOURNAL as well as special articles contributed by leading scientists and technologists with the purpose of making the JOURNAL a record of original research and a report of progress in scientific fields.

The publication of "The Physics of the Air," by Dr. W. J. Humphreys, Professor of Meteorological Physics, U. S. Weather Bureau, was nearing completion during the period covered by this report and orders were received for several hundred copies.

The notes from the various scientific Bureaus and Research Laboratories were continued throughout the year and contained the most recent accounts of the activities of these various institutions.

The material published under the heading of Current Topics was prepared by several members of the Institute.

The high costs continued during the period of this report, and there is still no prospect of any change. The publication expenses for the year are as follows:

Printing .....	\$12,234.38
Reprints .....	181.84
Illustrations .....	2,341.74
Year Book .....	728.97
Miscellaneous Expense .....	426.16

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Total ..... \$15,913.09

A complete set of the JOURNAL, with the various index volumes, was contributed to the University of Louvain for the restoration of its library.

Acknowledgment is due to our Associate Editors for valuable co-operation rendered during the year.

Respectfully submitted,

GEORGE D. ROSENGARTEN,

*Chairman.*

PHILADELPHIA, PA., JANUARY 12, 1921.

## REPORT OF THE COMMITTEE ON SECTIONAL ARRANGEMENTS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

*To the Board of Managers of The Franklin Institute:*

During the year ending September 30, 1920, nineteen meetings were conducted by the several sections of the Institute, and five meetings were held during the season with other local societies, as follows:

Total Number of Meetings Held: 19.

Section of Physics and Chemistry: Eleven meetings.

October 23, 1919.

"Flash and Sound Ranging Apparatus for the Location of Guns." Augustus Trowbridge, Ph.D., D.S.M., D.S.O., Chev. L. H., Professor of Physics, Princeton University. Illustrated.

November 6, 1919.

"American Dye Industries Present and Future." Dr. Bernhard C. Hesse, New York, N. Y. Illustrated.

November 13, 1919.

"Nutrition and Physical Efficiency." Dr. E. V. McCollum of the School of Hygiene and Public Health, The Johns Hopkins University. Illustrated.

December 11, 1919.

"Motor Fuels." Dr. E. W. Dean, Petroleum Chemist, Bureau of Mines. Illustrated.

January 8, 1920.

"The Physics of Flight." Dr. David L. Webster, Assistant Professor of Physics, Massachusetts Institute of Technology, Formerly Captain Aviation Section Signal Officers' Reserve Corps. Illustrated.

January 15, 1920.

"The Audion, Its Action and Some Recent Application." Dr. Lee de Forest of New York City. Illustrated by lantern slides and apparatus.

February 5, 1920.

"Helium." Dr. R. B. Moore, Chief Chemist, Bureau of Mines. Illustrated by lantern slides and experiments.

March 4, 1920.

"The Chemistry of the Earth's Crust." Dr. Henry S. Washington, Petrologist, Geophysical Laboratory, Carnegie Institution of Washington. Illustrated.

**YEAR BOOK OF**

**March 11, 1920.**

**"Photographing Sound Waves from Large Guns and Projectiles." Dr. Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Illustrated by lantern slides and experiments.**

**March 25, 1920.**

**"Optical Glass and Its Future as an American Industry." Dr. Arthur L. Day, Director, Geophysical Laboratory, Carnegie Institution of Washington. Illustrated by lantern slides and specimens.**

**April 1, 1920.**

**"Aeronautical Instruments." Dr. Charles E. Mendenhall, Professor of Physics, University of Wisconsin. Illustrated.**

**ELECTRICAL SECTION—TWO MEETINGS.**

**October 30, 1919.**

**"Wireless Telephony." Mr. N. H. Slaughter, Engineering Department, Western Electric Company, New York City, formerly Lt. Col. in the Signal Corps, U. S. A. Illustrated by lantern slides and experimental demonstrations.**

**April 8, 1920.**

**"Electric Welding as Applied to Shipbuilding." Comfort A. Adams, S.B., E.E., Dean of the Harvard Engineering School. Illustrated.**

**MINING AND METALLURGICAL SECTION—THREE MEETINGS.**

**December 4, 1919.**

**"Destruction of French Coal Mines and Their Rehabilitation." Mr. George S. Rice, Chief Mining Engineer, Bureau of Mines. Illustrated.**

**January 29, 1920.**

**"Fundamental Principles to be Considered in the Heat Treatment of Steel." Albert Sauveur, Professor of Metallurgy and Metallography, Harvard University. Illustrated by lantern slides and charts.**

**April 15, 1920.**

**"Recent Progress in the Metallurgy of Non-Ferrous Metals." Dr. D. A. Lyon, Bureau of Mines. Illustrated.**

**MECHANICAL AND ENGINEERING SECTION—TWO MEETINGS.**

**October 2, 1919.**

**"The American Air Service at the Front." Brigadier General William Mitchell, Division of Military Aeronautics, War Department. Illustrated.**



Fund	Increase	Reason for Increase
Ware Building Endowment Fund .....	5.15	Transfer of interest to principal.
Franklin Institute Building Fund .....	11,889.91	Increase through interest and income.
<hr/>		
\$58,075.39		

\* This fund is the merging, as of September 30, 1920, of the Lewis S. Ware Building Fund, the Elizabeth M. Graff Fund, and the Building Money Fund.

On November 1, 1919, the Orphans' Court approved the final account of the Executors of the Estate of Lewis S. Ware, awarding to the Institute an account of the bequest for the upkeep of the Ware Sugar Library \$18,788.42 and to the building fund of the Institute \$18,786.74.

Under date of September 15, 1920, the Orphans' Court approved the schedule of distribution presented by the Executors of the Estate of Harriet Blanchard, awarding the Institute the sum of \$50,000 plus a further sum of \$5,199.87.

Your Committee was chiefly concerned during the year with negotiations in connection with the Bequest of Henry W. Bartol and is happy to report that compromises were reached with the contestants to the will which are regarded as favorable to the Institute. All opposition is withdrawn and the necessary measures are being taken for the final settlement of the estate. On July 13, 1920, the Orphans' Court approved the account of the administrator's pendent lite and authorized the agreement which had been reached with the representatives of the widow. The audit of the estate, as of that date was:

Principal .....	\$2,207,276.14
Income .....	87,206.14
Total .....	<hr/> \$2,354,482.28

Respectfully submitted,

COLEMAN SELLERS, JR.,  
Chairman.

PHILADELPHIA, January 12, 1921.

## REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the President and Members of The Franklin Institute:

Established in 1834, the Committee in Science and the Arts has completed its eighty-sixth year of continuous service to the Institute. During this year the Committee has investigated and disposed of twenty-two cases and has seventeen cases pending.

The Standing Sub-Committee on The Franklin Medal and the Standing Sub-Committee on Literature met as required during the year and upon their





A detailed statement of the work of the Committee during the past year follows.

Respectfully submitted,

C. PENROSE,  
Chairman.

PHILADELPHIA, January 12, 1921.

#### APPENDIX.

#### STATEMENT OF THE COMMITTEE'S OPERATION FOR THE YEAR ENDING SEPTEMBER 30, 1920.

Cases pending October 1, 1919 .....	19
Applications during the year .....	16
Special Reports .....	4
	—
	39
Disposed of during the year .....	22
Leaving pending .....	17

#### AWARDS MADE.

Franklin Medal Awards .....	2
Howard N. Potts Awards .....	2
Edward Longstreth Awards .....	6
Certificate of Merit Awards .....	4
	—
	14

#### AWARDS MADE DURING THE YEAR.

##### THE FRANKLIN MEDAL.

Sir Charles Algernon Parsons, of Newcastle-on-Tyne, England, "in recognition of his epoch-making labors on the construction and development of steam-turbines which have revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels, and the driving of electrical generators."

Professor Svante August Arrhenius, of Stockholm, Sweden, "in recognition of his contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

##### THE HOWARD N. POTTS MEDAL.

Clarence P. Landreth, of Philadelphia, Pa., for his inventions and improvements embodied in the Landreth Electrolytic Sewage Process.

Wendell Addison Barker, of Elkhart, Ind., for his Wrenchless Chuck.

**THE EDWARD LONGSTRETH MEDAL.**

M. Lukiesh, of the Nela Research Laboratory, Nela Park, Cleveland, Ohio, for his paper, entitled "The Visibility of Airplanes," in the JOURNAL.

William Wallace Kemp, of Baltimore, Md., jointly with William H. Van Horn, for his inventions embodied in the Kemp Gas System.

William H. Van Horn, of Baltimore, Md., jointly with William Wallace Kemp, for his inventions embodied in the Kemp Gas System.

Morris E. Leeds, of Philadelphia, Pa., for his inventions and improvements embodied in Indicating and Recording Devices.

John Walter Ledoux, of Philadelphia, for his Simplex Fluid Meter.

H. Clyde Snook, of New York, for his inventions embodied in the Snook X-ray System.

**THE CERTIFICATE OF MERIT.**

David Landau, of New York, for the paper prepared in conjunction with Percy H. Parr, entitled "A New Theory of Plate Springs," in the JOURNAL.

Percy H. Parr, of New York, for the paper prepared in conjunction with David Landau, entitled "A New Theory of Plate Springs," in the JOURNAL.

Charles W. Hays, of Michigan City, Ind., jointly with Joseph W. Hays, for his inventions embodied in the Hays CO<sub>2</sub> and Draft Recorder.

Joseph W. Hays, of Michigan City, Ind., jointly with Charles W. Hays, for his inventions embodied in the Hays CO<sub>2</sub> and Draft Recorder.

**ELLIOTT CRESSON MEDAL RECOMMENDATION.**

(Award Pending.)

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

**HOWARD N. POTTS MEDAL RECOMMENDATION.**

(Award Pending.)

Edward Payson Bullard, Jr., of Bridgeport, Conn., for the "Automatic Machine Tool."

# THE FRANKLIN INSTITUTE AWARDS

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OCTOBER, 1920, TO JUNE, 1921.

## THE FRANKLIN MEDAL.

Professor Charles Fabry, of Paris, France, "in recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

Mr. Frank Julian Sprague, of New York, N. Y., "In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

## THE ELLIOTT CRESSON MEDAL.

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

W. L. R. Emmet, of Schenectady, New York, for his work on the Electric Propulsion of Ships and Prime Movers.

## THE HOWARD N. POTTS MEDAL.

Edward Payson Bullard, Jr., of Bridgeport, Connecticut, for the "Automatic Machine Tool."

Elmer V McCollum, of Baltimore, Maryland, for his paper entitled "Nutrition and Physical Efficiency," in the JOURNAL.

Alfred O. Tate, of Cranston, Rhode Island, for his Electrolytic Process of Waterproofing Textile Fabrics.

## THE EDWARD LONGSTRETH MEDAL.

Leason H. Adams, of Washington, D. C., for the paper prepared in conjunction with Erskine D. Williamson, entitled "The Annealing of Glass," in the JOURNAL.

Professor J. Bergonie, of Bordeaux, France, for his Application of Electro-Magnetic Mean and Apparatus to the Location of metallic fragments imbedded in Muscular Tissues.

W. Barton Eddison, of Ardsley-on-Hudson, New York, for his inventions and improvements embodied in the Surface Combustion Burner.

B. H. Hite, of Morgantown, West Virginia, for his Method of Sterilization by High Pressure.

Goddank L. Kothny, of Philadelphia, Pennsylvania, jointly with Robert

Suczek, for his inventions embodied in the Radojet Air Pump.

Jacob M. Spitzglass, of Chicago, Illinois, for his inventions embodied in the Republic Flow Meter.

Robert Suczek, of Philadelphia, Pa., jointly with Goddank L. Kothny, for his inventions embodied in the Radojet Air Pump.

Erskine D. Williamson, of Washington, D. C., for the paper prepared in conjunction with Leason H. Adams, entitled "The Annealing of Glass," in the JOURNAL.

#### THE CERTIFICATE OF MERIT.

Eugene C. Bingham, of Easton, Pa., for the inventions and improvements embodied in the Variable Pressure Viscometer.

Joseph S. Hepburn, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with E. Quintard St. John and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

Frank Morton Jones, of Wilmington, Delaware, for the paper prepared in conjunction with Joseph S. Hepburn and E. Quintard St. John, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

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# FRANKLIN MEDAL AWARDS

1915-1921.

ARRHENIUS, SVANTE AUGUST.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena, and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance." 1921.

LORENTZ, HENDRIK ANTOON.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.



March 11, 1920.

"Photographing Sound Waves from Large Guns and Projectiles." Dr. Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Illustrated by lantern slides and experiments.

March 25, 1920.

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Franklin Institute Building		
Fund .....	11,889.91	Increase through interest and income.
	<hr/>	
	\$58,075.39	

\* This fund is the merging, as of September 30, 1920, of the Lewis S. Ware Building Fund, the Elizabeth M. Graff Fund, and the Building Money Fund.

On November 1, 1919, the Orphans' Court approved the final account of the Executors of the Estate of Lewis S. Ware, awarding to the Institute on account of the bequest for the upkeep of the Ware Sugar Library \$18,788.42 and to the building fund of the Institute \$18,786.74.

Under date of September 15, 1920, the Orphans' Court approved the schedule of distribution presented by the Executors of the Estate of Harriet Blanchard, awarding the Institute the sum of \$50,000 plus a further sum of \$5,199.87.

Your Committee was chiefly concerned during the year with negotiations in connection with the Bequest of Henry W. Bartol and is happy to report that compromises were reached with the contestants to the will which are regarded as favorable to the Institute. All opposition is withdrawn and the necessary measures are being taken for the final settlement of the estate. On July 13, 1920, the Ophans' Court approved the account of the administrator's pendent lite and authorized the agreement which had been reached with the representatives of the widow. The audit, of the estate, as of that date was:

Principal .....	\$2,267,276.14
Income .....	87,206.14
Total .....	<hr/> \$2,354,482.28

Respectfully submitted,

COLEMAN SELLERS, JR.,  
*Chairman.*

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

*To the President and Members of The Franklin Institute:*

Established in 1834, the Committee in Science and the Arts has completed its eighty-sixth year of continuous service to the Institute. During this year the Committee has investigated and disposed of twenty-two cases and has seventeen cases pending.

The Standing Sub-Committee on The Franklin Medal and the Standing Sub-Committee on Literature met as required during the year and upon their



A detailed statement of the work of the Committee during the past year follows.

Respectfully submitted,

C. PENROSE,  
Chairman.

PHILADELPHIA, January 12, 1921.

APPENDIX.

STATEMENT OF THE COMMITTEE'S OPERATION  
FOR THE  
YEAR ENDING SEPTEMBER 30, 1920.

Cases pending October 1, 1919 .....	19
Applications during the year .....	16
Special Reports .....	4
	—
	39
Disposed of during the year .....	22
Leaving pending .....	17

AWARDS MADE.

Franklin Medal Awards .....	2
Howard N. Potts Awards .....	2
Edward Longstreth Awards .....	6
Certificate of Merit Awards .....	4
	—
	14

AWARDS MADE DURING THE YEAR.

THE FRANKLIN MEDAL.

Sir Charles Algernon Parsons, of Newcastle-on-Tyne, England, "in recognition of his epoch-making labors on the construction and development of steam-turbines which have revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels, and the driving of electrical generators."

Professor Svante August Arrhenius, of Stockholm, Sweden, "in recognition of his contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

THE HOWARD N. POTTS MEDAL.

Clarence P. Landreth, of Philadelphia, Pa., for his inventions and improvements embodied in the Landreth Electrolytic Sewage Process.  
Wendell Addison Barker, of Elkhart, Ind., for his Wrenchless Chuck.



# THE FRANKLIN INSTITUTE AWARDS

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OCTOBER, 1920, TO JUNE, 1921.

## THE FRANKLIN MEDAL.

Professor Charles Fabry, of Paris, France, "in recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

Mr. Frank Julian Sprague, of New York, N. Y., "In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

## THE ELLIOTT CRESSON MEDAL.

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

W. L. R. Emmet, of Schenectady, New York, for his work on the Electric Propulsion of Ships and Prime Movers.

## THE HOWARD N. POTTS MEDAL.

Edward Payson Bullard, Jr., of Bridgeport, Connecticut, for the "Automatic Machine Tool."

Elmer V McCollum, of Baltimore, Maryland, for his paper entitled "Nutrition and Physical Efficiency," in the JOURNAL.

Alfred O. Tate, of Cranston, Rhode Island, for his Electrolytic Process of Waterproofing Textile Fabrics.

## THE EDWARD LONGSTRETH MEDAL.

Leason H. Adams, of Washington, D. C., for the paper prepared in conjunction with Erskine D. Williamson, entitled "The Annealing of Glass," in the JOURNAL.

Professor J. Bergonie, of Bordeaux, France, for his Application of Electro-Magnetic Mean and Apparatus to the Location of metallic fragments imbedded in Muscular Tissues.

W. Barton Eddison, of Ardsley-on-Hudson, New York, for his inventions and improvements embodied in the Surface Combustion Burner.

B. H. Hite, of Morgantown, West Virginia, for his Method of Sterilization by High Pressure.

Goddank L. Kothny, of Philadelphia, Pennsylvania, jointly with Robert

Suczek, for his inventions embodied in the Radojet Air Pump.

Jacob M. Spitzglass, of Chicago, Illinois, for his inventions embodied in the Republic Flow Meter.

Robert Suczek, of Philadelphia, Pa., jointly with Goddank L. Kothny, for his inventions embodied in the Radojet Air Pump.

Erskine D. Williamson, of Washington, D. C., for the paper prepared in conjunction with Leason H. Adams, entitled "The Annealing of Glass," in the JOURNAL.

#### THE CERTIFICATE OF MERIT.

Eugene C. Bingham, of Easton, Pa., for the inventions and improvements embodied in the Variable Pressure Viscometer.

Joseph S. Hepburn, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with E. Quintard St. John and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

Frank Morton Jones, of Wilmington, Delaware, for the paper prepared in conjunction with Joseph S. Hepburn and E. Quintard St. John, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

E. Quintard St. John, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with Joseph S. Hepburn and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

# FRANKLIN MEDAL AWARDS

1915-1921.

ARRHENIUS, SVANTE AUGUST.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena, and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance." 1921.

LORENTZ, HENDRIK ANTOON.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.

MARCONI, GUGLIELMO.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

ONNES, HEIKE KAMERLINGH.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON.

"In recognition of his epoch-making success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

RICHARDS, THEODORE WILLIAM.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

SPRAGUE, FRANK J.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.



## CRESSON MEDAL AWARDS.

1856-1921.

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, DR. LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixtures of Metals.—1904

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-Wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H., AND ALFRED, H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PROF. AND MADAME.

Researches Resulting in the Discovery of Radium.—1909.

DELANDTSHEER, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUTT.

Electric Motor and Battery.—1881.

HADFIELD, ROBERT A.

Advancement of Metallurgical Science.—1910.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

HOWE, H. M.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

LANSTON, T.

Monotype Machine.—1896.

LEVY, L. E.

Acid Blast Method and Apparatus for Etching Metal Plates.—1900.

LEVY, L. E.

Machine for Powdering Plates for Etching.—1904.

LEWIS, COL. ISAAC NEWTON.

Machine Gun.—1918.

LINDE, KARL P. G.

Refrigeration Processes.—1914.

LOWE, THADDEOUS S. C.

Water Gas Process and Apparatus.—1886.

LOVEKIN, L. D.

Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.

LUMIÈRE, AUGUSTE AND LOUIS.

Color Photography.—1909.

MALLET, A.

Articulated Compound Locomotive.—1908.

MARKS, G. E.

Improvements in Artificial Limbs.—1893.

MASON AND HAMLIN COMPANY.

Liszt Organ.—1901.

MERGENTHALER, O.

Linotype.—1889.

MICHELSON, A. A.

Work in Physical Optics.—1912.

MOISSAN, HENRI.

Investigations with the Electric Furnace.—1898.

MORLEY, E. W.

Determination of Fundamental Magnitudes in Chemistry.—1912.

NOBLE, ALFRED.

Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E. JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine.—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Contruction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

SAUVEUR, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

SPELLIER, LOUIS H.

Time Telegraph.—1881.

SPRAGUE, F. J.

Multiple Unit System of Electric Traction.—1903.

SQUIER, MAJOR GEO. OWEN.

Multiplex Telephony.—1912.

STEINMETZ, C. P.

Application of Analytics to Electrical Engineering.—1913.

STRATTON, S. W.

Leading Work in Metrology.—1912.

TALBOT, B.

Open Hearth Steel Process.—1909.

TATHAM, W. P.

Printing Press.—1875.

TAYLOR, E. R.

Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.

TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.

Process of Treating Tool Steel.—1902.

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

U. S. GEOLOGICAL SURVEY.

Exhibit of Survey.—1900.

UNDERWOOD TYPEWRITER COMPANY.

Typewriter.—1909.

VAUCLAIN, S. M.

Compound Locomotive.—1891.

VERNAZ, ALEXIS.

Milling Files.—1909.

VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.

Spindle Support.—1891.

WALKUP, L.

Air Brush.—1886.

WATERHOUSE, A. G., AND FORBES, JOHN S.

Art of Automatically Heating and Sterilizing Fluids.—1901.

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

“Econometer.”—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

### POTTS MEDAL AWARDS.

1911-1921.

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

“Plants and Relation to Nitrate in Soils” (Paper).—1912.

BONE, WILLIAM A.

“Surface Combustion” (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

“Reflecting Power of Metals” (Paper).—1911.

DAHLGREN, ULRIC.

“The Production of Light by Animals” (Paper).—1917.

GRAY, ALEXANDER.

“Modern Dynamo Electric Machinery” (Paper).—1918.

HUMPHREYS, WILLIAM J.

“The Thunderstorm and Its Phenomena” (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., and BIZZELL, JAMES A.

“Plants and Relation to Nitrate in Soils” (Paper).—1912.

McCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

### LONGSTRETH MEDAL AWARDS.

1890-1921.

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.



BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BRADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

BRISTOL, W. H.

Recording Pressure Gauge.—1894.

BROWN, HAROLD P., AND EDISON, THOMAS A.

Rail Bonds and Electrical Contacts.—1899.

CAFFREY, C. S., AND COMPANY.

Improvement in Carriages and Wagons.—1900.

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

"Continuous Electric Oscillations" (Paper).—1913.

CHANCE, E. M.

"Pathogenic Mine Atmospheres" (Paper).—1912.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Cortlandt, Howe Ventilating Stove.—1894.

COLLINS, FRANK W., AND CLARK, WM. H.

Ventilating Stove.—1894.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete"  
(Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

“Researches on the Corrosion of Iron and Steel” (Paper).—1908.

DANA, A. S., KENNELLY, A. E., ACHARD, F. H.

“Experimental Researches on the Skin Effect in Steel Rails” (Paper).  
—1917.

DESHLER, CHARLES, and McALLISTER, EDWARD J.

Portable Photometer.—1900.

DeVOE, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

EBERHARDT, HENRY F., AND ULRICH, F. L.

Radial Gang Cutter.—1904.

EDDISON, WILLIAM BARTON.

Jet Entraining Apparatus.—1921.

EDISON, THOMAS A., AND BROWN, HAROLD P.

Rail Bonds and Electrical Contacts.—1899.

EDWARDS, LEVI TALBOT.

Compound Air-Lift System.—1918.

ELLIS, CARLETON.

Paint and Varnish Remover.—1916.

EVE, A. S.

“Modern Views on the Construction of the Atom” (Paper).—1916.

FAY, C. N., SHOLES, Z. G., AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

FOLLETT, W. I.

Time Stamp.—1906.

FOLMER AND SCHWING MFG. COMPANY.

Graflex Cameras.—1905.

FORBES, J. S., AND ADAMS, W. G.

Stop Valve for Radiators.—1893.

FRICK, FRED.

Electric Program Clock.—1899.

FULLER, G. W.

“Biochemical and Engineering Aspects of Sanitary Water Supply”  
(Paper).—1916.

GOLDMAN, HENRY.

Arithmachine.—1901.

GOODYEAR, CHARLES.

Projection Lantern.—1895.

GRANBERY, J. H.

Stadia Rod.—1909.

HEILPRIN, A.

Improved Ventilating Car Window.—1897.

HENNING, G. C.

Pocket Recorder for Tests of Materials.—1899.

HEPBURN, J. S.

"Chemistry of Sugar" (Paper).—1911.

HERR, H. T.

"Development of Steam Turbines" (Paper).—1914.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J., AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER Co.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, H. E., KINGSBURY, E. F., KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

IVES, H. E.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, F. E.

Photo-Micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnect.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).  
—1917.

KINGSBURY, E. F.; KARRER, E.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper). 1912.

LEDOUX, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper). 1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MILEY, HENRY M., AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NORTHROP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

**RANKIN, GEORGE A.**

“Portland Cement” (Paper).—1917.

**RECKLINGHAUSEN, M. VON.**

“Ultra-Violet Rays” (Paper).—1915.

**REESE, B. D.**

Dirigible Balloon.—1910.

**REEVES, MILTON O.**

Variable Speed Countershaft.—1900.

**REGAN, H. C., JR.**

Closed Conduit Electric Railway.—1897.

**RICHARDS, G. M.**

Automatic Fluid Pressure Friction Clutch.—1897.

**RIKER, C. L.**

Lavatory.—1900.

**RINGLAND, ALBERT, AND SCHOENFUSS, F. H.**

Portable Brinell Meter.—1917.

**ROBY, HENRY W.**

Screw Jack.—1891.

**ROEDER, J. R.**

Improvement in Windows.—1892.

**ROPER, CHARLES.**

Safety Propellers—1909.

**ROSENDALE BELTING COMPANY.**

Camel Hair Belting.—1893.

**ROUSSEL, W. J.**

Cipher Code System.—1902.

**RUSBY, J. M.**

“Industrial Combustible Gases” (Paper).—1914.

**RUSHTON, K.**

Improvements in Trailing Trucks for Locomotives.—1910.

**RUUD, EDWIN.**

Instantaneous Automatic Water Heater.—1904.

**SCHEMERHORN, W. GEORGE.**

Folding Boat.—1891.

**SCHLINK, FREDERICK J.**

Stabilized Platform Weighing Scale.—1919.

**SCHMIDT, MAX, AND SIEBER, JOSEPH.**

Movable Sidewalk.—1894.

**SCHMIDT, HENRY J., AND BONNELL, RUSSELL.**

Gate Valves.—1901.

**SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.**

Portable Brinell Meter.—1917.

**SCHREINER, O., AND LATHROP, E.**

“Organic Constituents in Soils” (Paper).—1912.

**SCRIPTURE, E. W.**

Color Sense Tester.—1903.

SEITZ, HENRY JEROME.

Coal Loading and Screening Machines.—1904.

SHARPLES, SPECIALTY COMPANY.

Super-Centrifuge.—1916.

SHAW, H. M.

Lightning Arrester.—1904.

SHELLENBACH, WILLIAM L.

Variable Speed Countershaft.—1903.

SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.

Typewriting Machine.—1901.

SIEBER, JOSEPH, AND SCHMIDT, MAX E.

Movable Side-Walk.—1894.

SKINNER, JOSHUA J.

"Soil Aldehydes" (Paper).—1919.

SNOOK, HOMER CLYDE.

X-Ray System.—1919.

SPITZGLASS, JACOB M.

Republic Flow Meter.—1921.

STAR BRASS MANUFACTURING COMPANY.

Steam Gauge.—1894.

STEARNS MANUFACTURING COMPANY.

Automatic High Speed Engine.—1892.

STONE, JOHN STONE.

"Propagation of Electric Waves Along Wires" (Paper).—1913.

STRADLING, GEORGE F.

"Modern Theories of Magnetism" (Paper).—1916.

STUMPF, J.

Una Flow Steam Engine.—1909.

SUCZEK, ROBERT, AND KOTHNY, G. L.

Radojet Air Pump.—1920.

TAINTOR, C. C.

Positive Saw-Set.—1895.

TAUSSIG, JOHN H., AND ZEEK, CHARLES F.

Automatic Operation of Water Gas Sets.—1918.

TEAL, B. F.

Anti-friction Universal Joint for Shafting.—1909.

THOMAS, C. C.

"Measurement of Gases" (Paper).—1912.

TOERRING, C. J.

Electric Arc Lamp.—1903.

TOWNSEND, T. F.

Improved Thermometer Support.—1907.

TUCKER, W. H.

Letter and Document Files.—1900.

TURNER, W. V.

"Locomotive Air-Brake" (Paper).—1911.

TUTWILER, C. C.

"Recovery of Gas Works by-Products" (Paper).—1915.

ULRICH, FREDERICK L., AND EBERHARDT, H. E.

Radial-Duplex Gang Cutters.—1904.

UNDERWOOD, JOHN, AND COMPANY.

Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WATERBURY TOOL COMPANY

Double Univesal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.



## CERTIFICATE OF MERIT AWARDS.

1885-1921.

**BAYLIS, R. N.**

Brush Holder and Brusher for Dynamos.—1909.

**BEIN, EMIL J.**

Letter and Document Files.—1900.

**BLANTON, E. A., JR.**

Shaft Coupling, Nut Locks, Cams, etc.—1910.

**BLONCK, W. A.**

Boiler Efficiency Meter.—1914.

**BLOUNT, EUGENE I., AND TAYLOR, WARREN H.**

Door Check.—1902.

**BRANCH, C. J.**

Electric Light Shade.—1909.

**BYERLY, F. E.**

Cutter and Cutter Head.—1893.

**CANDEE, C. H.**

Car Truck and Journal Bearings.—1887.

**COOK, J. S.**

Self-Lubricating Journal Box.—1898.

**DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.**

Magnetic Lamp.—1908.

**DERYCKE, J.**

Steam Separator.—1894.

**DODGE, W. W.**

Wooden Split Pulley.—1885.

**DUNN, G. S.**

Automatic Electric Brake Motor.—1902.

**ELLSWORTH, F. G.**

The Knudson and Ellsworth Telephone.—1891.

**ELTONHEAD, W. B.**

Nut Lock.—1885.

**FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.**

Magnetic Lamp.—1908.

**GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEIN-METZ, C. P.**

Magnetic Lamp.—1908.

**GETTY, JOHN K.**

Bicycle Support.—1896.

**GILSON, EMERY G.**

Calorizing Process.—1918

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improved in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

MCLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp —1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.

Magnetic Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.

Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER AND COMPANY.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-Off for Slide Valve Engines.—1889.

## JOHN SCOTT MEDAL AWARDS.

1835-1918.

ABT, R.

System of Mountain Railways.—1889.

ACHESON, E. G.

"Carborundum."—1894.

ACHESON, E. G.

Artificial Graphite.—1901.

ADT, J. B.

Tobacco Machine.—1901.

AKELEY, CARL E.

Cement-Gun.—1916.

ALBERT, C. F.

Musical Instruments.—1901.

ALGER, H. C.

Liquid Measurer.—1912.

ALMOND, T. R.

Angular Coupling.—1892.

ALMOND, T. R.

Flexible Tube.—1897.

AMERICAN PRISMATIC LIGHT COMPANY.

Light Projecting Glass.—1901.

ANDERSON, H. N.

Gear Rolling Machine.—1915.

ANDERSON, LEVI.

File Cutting.—1842.

ANDERSON, WILLIAM.

Apparatus for Water Purification.—1891.

ASHFORD, HENRY.

Boat Attaching and Detaching Apparatus.—1883.

ATKINS, J.

Self-Raking Automatic Reaper and Mower.—1854.

ATKINSON, J.

Gas Engine.—1889.

BABBITT, I.

Axle Boxes for Railway Cars.—1840.

BABBITT, I.

Soft Metal Boxes.—1842.

BAEKLAND, LEO H.

Bakelite.—1909.

BAKER, J. G.

Pressure Bower.—1875.

BALDWIN, F. S.

Caculating Machine.—1874.

BALDWIN, F. R.

Boiler Tube Cleaner.—1893.

BALLENTINE, W. I.

Apparatus for Testing Hardness and Density of Metal, etc.—1908.

BALZER, S. M.

Device for Backing off and Forming Milling Cutters.—1896.

BARDWELL, JOHN.

Votometer.—1901.

BASSETT, H.

Compasses.—1835.

BATCHELLOR, B. C.

Pneumatic Dispatch Tube Apparatus.—1899.

BATDORF, C. S.

Coin Counting and Wrapping Machine.—1914.

BATES, ALBERT J.

Improved Corliss Engine.—1895.

BATES, ROBERT.

Instrument for the Cure of Stammering.—1854.

- BEADLE, C.; BEVAN, E. J.; CROSS, C. F.  
Cellulose Products.—1895.
- BEAN, E. W.  
Device for Ascertaining Latitude.—1837
- BEECHER, JAMES.  
Hollow Handled Cutlery.—1883.
- BEHREND, B. A.  
High Speed Electric Generators.—1909.
- BEHRNS, G. L. H., AND BREMAR, A.  
Aspirator for Mill Stones.—1877.
- BELL, CHICHESTER A., AND TAINTER, SUMMER.  
Apparatus for Recording Sound.—1900.
- BENNOR, JOSEPH.  
Siphon Trap.—1884.
- BENNOR, JOSEPH.  
Knitting Machine.—1892.
- BERKEFELD, W.  
Germ Proof Water Filter.—1893.
- BERLINER, E.  
Gramophone.—1897.
- BEVAN, E. J.; BEADLE, C.; CROSS, C. F.  
Cellulose Products.—1895.
- BILGRAM, HUGO.  
Bevel Gear Cutter.—1887.
- BILGRAM, HUGO.  
Gearing for Metal Planners.—1882.
- BILYEU, THOMAS.  
International Money Machine.—1917.
- BLAKEY, THOMAS W., AND COURTENAY, WILLIAM.  
Reconstructed Granite.—1900.
- BLICKENSDECKER, GEORGE C.  
Typewriting Machine. 1901.
- BLODGETT BROTHERS.  
Electrical Signal Clock.—1883.
- BLONDEL, ANDRE, AND PAAROWDAKI, SPIRIDION.  
Holophone Globes.—1898.
- BRADLEY, ANDREW.  
Stencil Machine.—1902.
- BRAMWELL, W. C.  
Feeding Machine for Fibrous Material.—1894.
- BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.  
Refrigeration Process.—1894.
- BREHMER, HUGO, AND HEYL, HENRY RAND.  
Wire Book Sewing Machine.—1883.
- BREMAR, A., AND BEHRNS, G. L. H.  
Aspirator for Mill Stones.—1877.
- BRIDGMAN, H. L.  
Automatic Ore Sampler.—1893.

ELLEN, J. A.

Convertible Cars, Traction Trucks.—1904.

ELSTON, J. W., AND TATHAM, B.

Safety Catch for Elevators.—1875.

BROWN, EDWARD.

Pyrometers.—1897.

BROWNING, JOHN M.

Automatic Pistol.—1906.

BURGER, H. J.

Photo-Polychrome Printing Apparatus.—1903.

BURRELL, JOHN H., AND METZLER, C. E.

Railway Signal Lantern.—1885.

BURROUGHS, W. S.

Calculating Machine.—1897.

BURROWS, AMOS E.

Feed-Water Regulator.—1904.

BURT, W. A.

Variation Compass.—1835.

BURTON, G. D.

Electric Forging Device.—1892.

BURTON, W. L.

Electric Heater.—1890.

CALAHAN, E. A.

Synchronous Multiplex Telegraphy.—1886.

CALDERHEAD, A.

Looms.—1840.

CAMPBELL, P. T., AND C. H.

Apparatus for Reconstructing Milk.—1904.

CARLETON, CYRUS, AND WILCOX, CHARLES H.

Automatic Tension and Improved Sewing Machines.—1875.

CARNELL, CHARLES.

Brick Machine.—1850.

CARNEY, THOS.; COOK, H.; AND PATTERSON, H. G. AND J. H.

Cash Registers.—1901.

CARROLL, W. T.

Non-Metallic Bearings.—1896.

CASTNER, H. Y.

Apparatus for the Manufacture of Sodium and Potassium.—1889.

CERASOLI, ALBERTO, AND HUMPHREY, H. A.

Hydraulic Pump.—1914.

CHABOT, CYPRIEN.

Shoe Sole Channelling Machine.—1885.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHABOT, CYPRIEN.

Shoe Sole Edge Turning Machine.—1885.

CHABOT, CYPRIEN.

Beveled Rim Watch Cases.—1886.

CHAMBERS, C.

Brick Machine.—1875.

CHAMBERS, C.

Book Folding and Pasting Machine.—1874.

CHAUVENET, WILLIAM.

Great Circle Protractor.—1857.

CHENOWETH, A. C.

Electric Conduits.—1890.

CHENOWETH, A. C.

Steel Concrete Foundation Piles.—1906.

CLARK, G. S.

Device for Safety Vaults.—1892.

CLAUD, G. M.; HESS, G. A.; FOCHE, EDMUND.

Process of Storing Explosive Gases.—1903.

CLEBORNE, C. J.

Bedstead.—1894.

COLBY, E. A.

Electric Furnace for Melting Metals.—1909.

COLTON, SABIN W.

Improved Locks.—1848.

CONNET, FREDERICK N., AND JACKSON, W. W.

Improved Venturi Meter.—1898.

COOK, H.; CARNEY, T.; PATTERSON, H. G. & J. H.

Cash Registers.—1901.

COOPER, DANIEL.

Time Recorder.—1898.

COURTENAY, WILLIAM, AND BLAKEY, THOMAS W.

Reconstructed Granite.—1900.

COWLES, EUGENE H., AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER-COWLES, SHERARD.

Method of Depositing Metals on Metallic Surfaces.—1911.

CREHORE, A., AND SQUIER, G. O.

Polarizing Photo-Chronograph.—1896.

CROSS, C. F.; BEADLE, CLAYTON; BEVAN, E. J.

Cellulose Products.—1895.

CROSS, W. A.

Horizontal Folding Door.—1903.

CYCLOSTYLE COMPANY.

Cyclostyle.—1888.

DALE, JOHN D.

Wood Molding Machine.—1857.

DARLING, J. D.

Apparatus for Producing Metals and Nitric Acid from Fused Nitrates.—1901.



DAVIS, JOB A.

Vertical Feed for Sewing Machine.—1875.

DENISON, L. C.

Corn Sheller.—1839.

DIETZ, GUSTAV.

High Speed Photographic Between-lens Shutter.—1909.

DILKS, J.

Water Gauges.—1853.

DOBBINS, E. J.

Daylight Rod.—1914.

DOBBINS, EDWARD J., AND MOFFETT, GEORGE.

Light Projecting Glass.—1901.

DOBLE, W. A.

Tangential Water Wheel—1904.

DOCK, H.

Rivett Thread Tool.—1901.

DODGE, J. M.

Storage Structure for Coal and Analogous Material.—1904.

DODGE, WALLACE H.

System of Rope Transmission.—1891.

DOERR, JOHN H., AND WIGMORE, WILLIAM H.

Sleeping Car.—1885.

DORR, JOHN V. H.

Hydrometallurgical Apparatus.—1916.

DOWNES, L. W.

Fireproof Insulated Wire.—1905.

DRESSLER, CONRAD D'HUC.

Tunnel Kiln.—1918.

DUNCAN, JOSEPH S.

Addressograph.—1903.

DUNHAM, JOSEPH M., AND MCKEMMIL, JOHN.

Metallic Drawing Rolls.—1894.

DUNN, B. W.

Testing Machine for Measuring Intensities of Impulsive Forces.—1898.

DURKEE, G. B., AND GOLDING, JOHN F.

Expanded Metal.—1897.

DUTTON, R. & Co.

Mowing Machine.—1877.

ECKSTEIN, H. G.

Feed Water Heater.—1884.

EDISON, T. A.

Mimeograph.—1889.

EDSON, J. B.

Pressure Recording Gauge.—1894.

FHBETS, C. J.

Improved Revolver.—1890.

ELDRED, BYRON.

Process for Flame Regulation.—1906.

ELDRIDGE, G. M.

Electro Magnetic Protector for Electric Instruments.—1884.

ELLIS, H.

Combined Calculating and Writing Machine.—1909.

ELMER AND LITTLE.

Chronometer.—1837.

EMERSON, J.

Power Scale.—1892.

ENGELHARD, C.

Heraeus Le Chatelier Pyrometer.—1907.

EWBANK, T.

Lead Pipes.—1835 .

FABER, GEORGE.

Magnetic Water Gage.—1853.

FAHY, FRANK P.

Permeameter.—1918.

FAWKES, JOSEPH W.

Steam Plow.—1859.

FELLOWS, E. R.

Machine and Cutter for Generating Gear Teeth.—1899.

FELT, D. E.

Comptometer.—1890.

FIELD, D. W., AND SPENCER, JOHN E.

Damper Regulator.—1893.

FISHER, ROBERT T.

Improved Book and Letter Typewriter.—1899.

FORTEN, R. B.

Telescope.—1840.

FOUCHE, E.; CLAUD, G. M. A.; HESS, G. M.

Process for Storing Explosive Gases.—1902.

FRAHM, HERMANN.

Speed Indicator, Frequency Teller and Revolution Counter.—1907.

FRANCIS, JEROME B.

Tooth Extractor.—1860.

FRAZER, PERSIFOR.

Apparatus for Quantitative Colorimetry.—1905.

FULLER, FRED L., AND GRISWOLD, GEORGE H.

Cash Register and Indicator.—1892.

FULLER, J. E.; BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.

Refrigeration Process.—1894.

FURBISH, ZACHARY T.

Ratchet Tools.—1904.

GARROD, R. P.

Annunciators.—1891.

GATES, JOHN.

Lubricator.—1888.

GIBBONS, C. L.

Street Railway Construction.—1892.

GILLESPIE, ALFRED J.

Voting Machine.—1902.

GLIDDENS, CARLOS; SHOLES, C. L.; SOULE, S. W.

Improved Typewriter.—1875.

GODDARD, K.

Carriage Axle.—1852.

GOETZ, G. M.

Device for Anchoring Beams.—1891.

GOLDBERG, H. E., AND WAHL, J. C.

Adding Machine.—1916.

GOLDING, J. F., AND DURKEE, G. B.

Expanded Metal.—1897.

GOLDSTEIN, A.

Pneumatic Fire Alarm Telegraph System.—1895.

GOODES, E. A.

Sewing Machine.—1875.

GOODWIN, WILLIAM FARR.

Mowing Machine.—1879.

GOODYEAR, ROBERT B.

Harness Motion for Power Looms.—1875

GOODYEAR, ROBERT B.

Shuttle Box Operating Mechanism.—1875.

GRANT, GEORGE B.

Calculating Machine.—1877.

GRANT, GEORGE B.

Calculating Machine.—1896.

GRAU, PHILIP J.

Feed Water Purifier and Heater.—1886.

GREENE, E. V.

Apparatus for Extracting Oil and Albuminoid from Corn.—1851.

GRIMES, W. C.

Water Gauge for Steam Boilers.—1851.

GRIMES, W. C.

Smut Machine.—1840.

GRISWALD, GEORGE H., AND FULLER, FRED L.

Cash Register and Indicator.—1892.

GROUPE, A. V.

Braiding Machine.—1900.

GUILLAUME, C. E.

Invar Alloy.—1914.

HADFIELD, ROBERT.

Manganese Steel.—1891.

HAHL, A. L.

Pneumatic Clock.—1901.

HAINES, ROBERT B., JR.

Automatic Micrometer Rolling Mill Plate Gauge.—1901.

HAKEWESSEL, REINHOLD, AND HENN, EDWIN C.

Automatic Screw and Metal Working Machine.—1901.

HALL, THOMAS.

Typewriter.—1884.

HALL, M. W.

Duplex Steam Pump.—1886.

HALLOCK, DAVID.

Weighing Scale.—1887.

HALLOWELL, HOWARD T.

Pressed Steel Shaft Hangers.—1906.

HAMMER, WILLIAM J.

Apparatus for Long Distance Phonographic and Telephonic Experiments.—1902.

HANNAY, J. B., AND SHEDLOCK, ALFRED.

Lucigen.—1891.

HANSON, HANS, AND HART, FREDERICK A.

Calculating and Typewriting Machine.—1915.

HARDINGE, H. W.

Conical Pebble Mill.—1915.

HARO, A LOPEX DE.

Electric Sea Compass; Automatic Electric Log Line.—1890.

HART, EDWARD.

Acid Container.—1891.

HART, FREDERICK A., AND HANSON, HANS.

Combined Calculating and Typewriting Machine.—1915.

HART, WALTER.

Hoisting Machine.—1891.

HEANY, J. A.

Enclosed Arc Lamp.—1904.

HECTROTTE, A. G.

Car Couping.—1848.

HELLINGS, J.

Mail Bag Fastener.—1890.

HENN, E. C., AND HAKEWESSEL, REINHOLD.

Automatic Screw and Metal Working Machine.—1901.

HERAEUS, W. C.

Fused Quartz Mercury Lamp.—1906.

HERMAN, HENRY O.

Star Ventilator.—1902.

HERR, H. A.

Liquid Extraction Apparatus.—1909.

HESS, G. A., CLAUD, G. M. A., FOCHE, E.

Process of Storing Explosive Gases.—1902.

- HEXAMER, C. J.**  
Apparatus for Preventing and Extinguishing Fires in Grinding Mills.—  
1888.
- HEYL, HENRY R., AND BREHMER, HUGO.**  
Wire Book Sewing Machine.—1883.
- HEYL, HENRY R.**  
Wire Fastened Paper Boxes.—1875.
- HIGGINS, A., AND JACOBS, C. B.**  
Alundum Refractories.—1909.
- HILL, T.**  
Calculating Instrument.—1843.
- HOBSON, A. E.**  
Hydraulic Shaping Press.—1890.
- HOLCOMB, A.**  
Reflecting Telescope.—1835.
- HOPKINS, EDWARD P.**  
Electric Arc Lamp.—1896.
- HOPKINS, N. M.**  
Pneumatic Water Pipe Cushioning.—1900.
- HOUGH, JAMES, AND LAUGHLIN, SAMUEL.**  
Drawing Tables.—1900.
- HUMPHREY, F. A.**  
Improved Sawing Machine and Guide.—1901.
- HUMPHREY, H. A., AND CERASOLI, ALBERTO.**  
Hydraulic Pump.—1914.
- HUTCHINS AND MARETT.**  
Tilting Chair.—1875.
- HYATT, I. S.**  
Purification of Water System.—1888.
- HYATT, J. W.**  
Roller Bearings.—1898.
- ILDER, J. D.; SMITH, A. C.; SUNDH, AUGUST; OTIS, SIDNEY.**  
Electric Elevator.—1902.
- IRWIN, JOHN H.**  
Lantern.—1873.
- IVES, FREDERICK E.**  
Isochromatic Photography.—1887.
- IVES, FREDERICK E.**  
Projecting Lantern and Appurtenances.—1890.
- IVES, FREDERICK E.**  
Parallax Stereogram.—1904.
- IVES, FREDERICK E.**  
New Form of Replica of Rowland Diffraction Grating.—1905.
- IVES, FREDERICK E.**  
Color Meter.—1907.

- JACKSON, WALTER W., AND CONNET, F. N.  
Improved Venturi Meter.—1898.
- JACOBS, C. B., AND HIGGINS, A. C.  
Alundum Refractories.—1909.
- JANDUS, WILLIAM.  
Enclosed Arc Lamp.—1895.
- JAY, PERRIE EGMOND.  
Automatic Anti-Freezing Valve.—1885.
- JENKINS, C. F.  
Motion Pictures Apparatus.—1909.
- JENKS, W.  
Fire Arms.—1840.
- JEWELL, M. R.; POWERS, T. B.; KELLY, J. F.  
Teleelectric Piano Player.—1910.
- JOHNSON, A. L.  
Bonding Joint for Electric Railways.—1896.
- JOHNSON, E. H.  
Interior Electric House Conduit.—1891.
- JONES, ALFRED C.  
Shaft Couplings.—1842.
- JONES, EVAN W.  
Underfeed Mechanical Stoker—1904.
- JONES, H. P.  
Baling Machine.—1901.
- JONES, J. R.  
Method of and Apparatus for Axle Rolling.—1892.
- KELLY, J. F.; POWERS, T. B.; JEWELL, M. R.  
Teleelectric Piano Player.—1910.
- KEMBLE, B. H.  
Wheel Hubs.—1883.
- KENT, A. ATWATER.  
Ignition System for Automobiles.—1914.
- KITE, J. S.  
Safety Beam.—1840.
- KNEASS, S. L.  
Injector.—1901.
- KOYL, C. H.  
Parabolic Semaphore.—1889.
- KURTZ, DAVID T.  
Cap Screws and Bolts—1905.
- LA RUE, S. H.  
Stove for Soft or Bituminous Coal.—1893.
- LATTIG, J. W.  
Automatic Electric Semaphore Signal.—1904.
- LAUGHLIN, SAMUEL, AND HOUGH, JAMES.  
Drawing Tables.—1900.

LECLERE, FRANCIS.

Black Printing Process.—1897.

LECLERE, FRANCIS.

Toothed Gear Wheel—1891.

LEONARD, H. W.

System of Motor Control.—1902.

LEVY, M. AND L. E.

Screens for Photo-Mechanical Engraving.—1897.

LEWIS, WILFRED; TABOR, HARRIS; MUMFORD, E.

Molding Machine.—1902.

LINCOLN, P. M.

Synchronism Indicator.—1902.

LITTLE AND ELMER.

Chronometer.—1837.

LOSS, HENRIK V.

Solid Steel Railway Wheels Manufactured by Hydraulic Forging with Rolling.—1904.

LOVEKIN, L. D.

Device for Relieving Forces due to Inertia and Weight of Valve Gears.—1910.

LOWE, J.

Spinning Mule.—1890.

LUNGREN, CHARLES M.

Incandescent Gas Light.—1892.

MACCOY, J. S.

Pneumatic Tool.—1890.

MCCALL, THOMAS A., AND PILLINGS, JOHN H.

Automatic Typewriter.—1917.

MCCAULEY, THOMAS, AND REED, C. J.

Speed-Jack.—1907.

MCCLELLAN, EZRA S.

Anti-Siphon Vent.—1892.

MCCRACKEN, EDWIN D.

Insulated Electrical Conductors.—1896.

MCINTIRE, C.

Electric Wire Connectors.—1890.

McKEE, M. A.

Process of Treating Printing Plates.—1912.

McKEMMIL, JOHN, AND DUNHAM, JOSEPH M.

Metallic Drawing Rolls.—1894.

McMAHAN, J.

Stereotyping Plate.—1835.

McMULLEN, JOHN.

Machine for Knitting Stockings.—1835.

MACHLET, GEORGE, AND REICHHELM, E. P.

Apparatus for Producing Fuel Gas.—1894.

- McCURDY, ARTHUR W.  
Apparatus for Developing Photographic Roll Prints.—1904.
- MADDOX, R. L.  
Substitution of Gelatine for Collodion in Photography.—1889.
- MAHAN, FRANCIS.  
Measure Case Ruler.—1837.
- MARCY, L. J.  
Magic Lantern.—1887.
- MARKS, A. A.  
Artificial Limbs.—1889.
- MARSDEN, M.  
Corn-pith Cellulose.—1896.
- MASON, A. J.  
Washer Punching Machine.—1891.
- MELLOR, L. B.  
Device for Measuring and Recording the Variable Diameter of Tubes.—1903.
- MERGENTHALER, O.  
Linotype.—1889.
- MERKET, LUZERNE, AND THOMAS, ALMER.  
Tempered Copper.—1891.
- MERRICK AND TOWNE.  
Boring Machine.—1840.
- MERSHON, R. D.  
Compensated Potential Indicator.—1901.
- METZLER, CHRISTIAN E., AND BURRELL, JOHN H.  
Railway Signal Lantern.—1885.
- MEYERS, J. G.  
Mausoleum.—1889.
- MEYLAN, EUGENE, AND RECKNIEWSKI, CAMILLE S.  
Electric Meter.—1893.
- MILLER, D. K.  
Self Locking Padlock.—1883.
- MILLIAU, EDWARD.  
Apparatus for Analyzing Fats and Oils.—1896.
- MOFFETT, GEORGE, AND DOBBINS, EDWARD J.  
Light Projecting Glass.—1901.
- MOORE, D. MCFARLAN.  
Vacuum-tube Light.—1909.
- MOORE, LEE C.  
Wire Testing Machine.—1904.
- MORRIS, HENRY G., AND SALOM, PEDRO G.  
Electric Automobile.—1897.
- MORSE, EVERETT F.  
Heat Gage.—1903.
- MORSE, EVERETT F.  
Drive Chains.—1901.



ANDERSON, A. J. C.

Complementary Color Designs and Crystal Patterns.—1894.

ANDERSON, J.

Technique of Glassware.—1896.

ANDERSON, J. H.

Notes on the Lighting.—1898.

ANDERSON, J. W.

Process and Process for Manufacturing Mosaics.—1898.

ANDERSON, J. W. — HILBERT; TABOR, H.

Building Machine.—1896.

ANDERSON, J. W.

Notes on the Lighting.—1883.

ANDERSON, J. W.

Notes on the Lighting for Railroad Curves.—1842.

ANDERSON, J. W.

Notes on the Lighting.—1891.

ANDERSON, J. W.; CORNWELL, C. B.

Notes on the Lighting for Rail-Bonding.—1906.

ANDERSON, J. W.

ANDERSON, J. W.

Notes on the Lighting.—1893.

ANDERSON, J. W.

Notes on the Lighting Metal Pipes.—1875.

ANDERSON, R. C.; HILDER, J. D.; SUNDH, AUGUST.

ANDERSON, R. C.

ANDERSON, R. C.

Notes on the Lighting Fabrics and Castings Therefrom.—1888.

ANDERSON, R. C.

Notes on the Lighting Investigating the Molecular Physics of Cast Iron.—1897.

ANDERSON, R. C. AND BLONDEL, ANDRE.

ANDERSON, R. C.

ANDERSON, R. C.

ANDERSON, R. C.

ANDERSON, R. C.; REYNOLDS, J. R.; TIRRELL, J. P.

Notes on the Lighting and Speed Limit System.—1906.

ANDERSON, R. C.

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ANDERSON, R. C.

ANDERSON, R. C.; PATTERSON, J. C.; CARNY, T.; COOK, H.

ANDERSON, R. C.

PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.  
Cash Registers.—1901.

PAYEN, C.  
Chloride Electrical Storage Battery.—1894.

PEALE, F.  
Coining Presses at the United States Mint, Philadelphia.—1840.

PENTZ, A. D.  
Boring and Milling Engine.—1891.

PERRY, N. W.  
Method of Series Electric Traction.—1894.

PFATISCHER, MATTHIAS.  
Variable Speed Motors.—1909.

PHELPS, L. J.  
Induction Telegraph.—1886.

PHOENIX IRON COMPANY.  
Automatic Cut-Off Steam Engine.—1886.

PILLINGS, JOHN H., AND MCCALL, THOMAS A.  
Automatic Typewriter.—1917.

PONTRICHET, J.  
"Heliographic" Paper.—1894.

POOLE AND COMPANY, J. MORTON.  
Grinding Metallic Calendar Rolls.—1875.

POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.  
Teleelectric Piano Player.—1910.

PRATT AND WHITNEY COMPANY.  
Taps and Gauges.—1883.

PRATT AND WHITNEY COMPANY.  
System of Interchangeable Cut Gears.—1886.

PRENTISS, H. S.  
Automatic Calendar.—1896.

PRIESTMAN, W. D. AND SAMUEL.  
Steam Engine.—1894.

PRUNTY, JOHN E.  
Relief Valve.—1875.

PRUTZMAN, A.  
Door Lock.—1836.

REAGAN, J.  
Grate Bars.—1908.

RECEVEUR, P. N.  
Rose Engine (Lathe).—1853.

RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.  
Electric Meter.—1893.

REDDAWAY, FRANK.  
Camel Hair Belting.—1898.

REED, CHARLES J., AND MCCAULEY, THOMAS.  
Speed-Jack.—1906.

REICHHELM, E. P., AND MACHLET, GEORGE.

Apparatus for Producing Fuel Gases.—1894.

RENO, J. W.

Escalator.—1910.

REYNOLDS, J. R. PALMER, FREDERICK. S.; TIRRELL, J. P.

Engine Gears and Speed Limit System.—1906.

REYNOLDS, J.

Apparatus for the Bird.—1890.

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Apparatus for the Bird.—1890.

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Apparatus for the Bird.—1890.

- SAYEN, H. L.  
Improved Roentgen Ray Tubes.—1898.
- SAXTON, J.  
Reflecting Pyrometer.—1842.
- SCHELLENBACH, WILLIAM S.  
System of Gearing.—1902.
- SCHMIDT, M. E.  
Moving Platform.—1906.
- SCHOOP, MAX ULRICH.  
Metal Spraying Process.—1917.
- SEE, H.  
Hydro-Pneumatic Ash Ejector.—1904.
- SEMPLE, J. B.  
Shell Torch or Tracer.—1905.
- SENNEFF, JACOB.  
Eye-Harness for Metallic Heddle.—1853.
- SEVERY, M. L.  
Printing Machine.—1898.
- SEYMOUR, C.  
Balancer for Pulleys, Fly Wheels, etc.—1878.
- SEXTON, A.  
Slide Rule.—1899.
- SHAW, T.  
Instrument for Testing Ignitable Gases in Mines.—1889.
- SHAW, THOMAS.  
Gunpowder Pile Driver.—1872.
- SHAW, THOMAS.  
Spiral Exhaust Nozzle.—1877.
- SHAW, THOMAS.  
Friction Buffer.—1883.
- SHAY, EPHRAIM.  
Geared Locomotive.—1892.
- SHEDLOCK, ALFRED, AND HANNAY, J. B.  
Lamp for Engineering Uses.—1891.
- SHIMER, P. W.  
Combustion Crucible.—1901.
- SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.  
Typewriter.—1875.
- SHORE, A. F.  
Scleroscope.—1909.
- SHUMAN, F. S.  
Wired Glass.—1894.
- SHUMAN, F.  
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.  
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.  
Typewriter.—1875.

**SPENCER J. G.**

### Hoisting Machines.—1891.

~~SPENCER~~ L. H.

**Electric Clock.—1887.**

SPENCER J. E., AND FIELD, D. W.

### Damper Regulator.—1893.

**SPERRY, E. A.**

### Gyroscope Compass.—1914.

**SPIELMAN, A.**

### Cloth Cutting Machine.—1914.

**SPIRO, C.**

### Barlock Typewriter.—1894.

**SPRATT, ORLANDS W.**

## Mercury Seal Trap.—1885.

**SPRINGER, ALFRED, AND ROEDER, F. A.**

### Torsion Balance.—1891.

SQUIER, G. O., AND CREHORE, A.

### Polarizing Photo-Chronograph.—1896.

**STACKHOUSE, THOMAS H.**

**Diagraph.—1895.**

# STAHLBERG, C.

**Time Dating Stamp.—1891.**

STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.

### Refrigeration Process.—1894.

**STEINBART, ALFRED, AND UEHLING, EDWARD.**

### Pneumatic Pyrometer.—1898.

**STEINBART, ALFRED, AND UEHLING, EDWARD.**

### Gas Composimeter.—1899.

## STELLWAGON, H. S.

### Sounding Apparatus.—1848.

STIERINGER, L.

### Improved Method of Electric Illumination.—1902.

STREET. CLEMENT F.

### Locomotive Stoker.—1915.

STICKLAND, W.

### Substitution of Lime for Salt for Preserving Lumber.—1840.

**SUNSHINE. AUGUST: OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.**

### Electric Elevator.—1902.

**SUBJECT: James J.**

THE PRESIDENT

50-252-2452

**Forest Map Using Green Compress.—1900.**

**THE HALLS OF THE HOUSE: MUMFORD, E.**

Spring 1962 - 1962

THE UNIVERSITY OF CHICHESTER, A.

— 1900.

- TALBOT, E.  
Improved Methods in the Manufacture of Steel.—1908.
- TATHAM, B., AND BRITTIN, J. W.  
Safety Catch for Elevators.—1875.
- TATTERSALL, ALFRED R.  
Flour Mill.—1917.
- TAYLOR, C. M., JR.  
Absorption Process for Butter Making.—1903.
- TEAL, C. A.  
Portable Hoist.—1889.
- THOMAS, ALMER, AND MERKET, LUZERNE.  
Tempered Copper.—1891.
- THOMSON, ELIHU.  
Electric Welding.—1889.
- THOMSON, ELIHU.  
Constant Current Arc Light Transformer.—1901.
- THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.  
Refrigeration Process.—1894.
- THUM, CHARLES D.  
Varnish Brushes.—1854.
- TIRRILL, A. A.  
Voltage Regulator.—1910.
- TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.  
Engine Stop and Speed Limit System.—1906.
- TOWNSEND, ISAAC.  
Tent Fastening.—1885.
- TWEDDELL, R. H.  
Method of Applying Hydraulic Power to Mechanical Work.—1894.
- TYLER, PHILOS B.  
Shifting Gauge Cock for Steam Boilers.—1835.
- TYSON, CHARLES.  
Machine to Unite Uppers to the Soles of Shoes.—1875.
- UEHLING, EDWARD, AND STEINBART, ALFRED.  
Gas Composimeter.—1899.
- UEHLING, EDWARD, AND STEINBART, ALFRED.  
Pneumatic Pyrometer.—1898.
- VAN KANNEL, T.  
Storm Door.—1890.
- VAUCLAIN, SAMUEL M.  
Truck Wheel Centres.—1891.
- VILLEROI, M.  
Telescope.—1849.
- VOYNOW, C. B., AND NICHOLS, H. B.  
Cast Zinc Joint for Rail Bonding.—1904.
- WAHL, J. C., AND GOLDBERG, H. E.  
Adding Machine.—1916.

- WAIT, W. B.  
Machine for Tangible Writing for Touch Reading.—1900.
- WALE, GEORGE AND COMPANY.  
Projection Lantern.—1875.
- WALSH, E. M. AND SYDNEY B.  
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALSH, SYDNEY B. AND E. M.  
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALTER, L. H.  
Method of Detecting Electrical Oscillations.—1907.
- WALTER, B.  
Electric Switch.—1905.
- WEBSTER, W. R.  
Apparatus for Observing the Relations between the Chemical Constitution and Ultimate Strength of Steel.—1897.
- WEHNELT, A.  
Interrupter for Induction Machines.—1905.
- WELIN, A.  
Life Saving Appliances on Board Ship.—1910.
- WESTINGHOUSE, GEORGE, JR.  
Railway Car Brake.—1874.
- WETZEL, F. J.  
Automatic Mechanical Stoker.—1909.
- WHARTON, WILLIAM, JR.  
Safety Railway Switch.—1873.
- WHEELER, S. S.  
Electric Fan.—1904.
- WHITALL, HENRY.  
Planisphere.—1883.
- WHITE, O. C.  
Adjustable Extension Movement in Ball and Socket Joints.—1889.
- WIEDIG, H. P.  
Chemical Fire Extinguisher.—1894.
- WIGMORE, WILLIAM H., AND DOERR, JOHN H.  
Sleeping Car.—1885.
- WILKIN, J. T.  
System of Generating and Forming Cycloidal Surfaces.—1894.
- WILCOX, CHARLES H., AND CARLETON, CYRUS.  
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- WILLANS, P. W.  
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- WILLMUNDER, H.  
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# TERMS AND PRIVILEGES OF MEMBERSHIP

The members of the Institute are divided into the following classes, viz.: *Resident Members, Stockholders, Life Members, Permanent Members, Non-resident and Associate Members.*

Any one interested in the purposes and objects of the Institute and expressing a willingness to further the same may become a member when proposed by a member in good standing and elected by the Board of Managers.

**Terms.**—Resident members pay Fifteen Dollars each year. The payment of Two Hundred Dollars in any one year secures Life Membership, with exemption from annual dues.

**Stock.**—Second-class stockholders pay an annual tax of Twelve Dollars per share, and the holder of one share is entitled by such payment to the privileges of membership.

**Privileges.**—Each contributing member (including non-residents) and stockholder of second-class stock is entitled to participate in the meetings of the Institute, to use the Library and Reading Room, to vote at the Annual Election for officers, to receive tickets to the lectures for himself and friend, to attend the Section meetings and to receive one copy of the JOURNAL free of charge except associate members, who may not take part in elections.

**Permanent Members.**—The Board of Managers may grant to any one who shall in any one year contribute to the Institute the sum of One Thousand Dollars a permanent membership, transferable by will or otherwise.

**Non-resident Life Members.**—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be elected as non-resident life members, and are required to pay an entrance fee of One Thousand Dollars and Five Dollars annually. Non-resident Life Members may vote.

Non-resident members are eligible, under the non-resident clause, on payment of the entrance fee, to be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

**Associate members** are accorded all the privileges of the non-resident class, but have no right to vote or hold office, upon the payment of an entrance fee of One Thousand Dollars. This class of membership is limited to persons under the age of twenty-five years. Upon reaching the age of twenty-five years they become eligible to the other classes of membership.

All applications must be made in writing, and dues must be paid to the date of application.



MORSELL, W. F. C.

Complementary Color Designs and Crystal Patterns.—1894.

MOSER, L.

“Bohemian” Glassware.—1886.

MOSKOWITZ, MORRIS.

System of Car Lighting.—1900.

MUELLER, H. C.

Apparatus and Process for Manufacturing Mosaics.—1898.

MUMFORD, EDGAR; LEWIS, WILFRED; TABOR, H.

Molding Machine.—1902.

NACKE, ARNOLD.

Screw Cutting Attachment.—1883.

NAGLEE, H. M.

Flat Bar or Edge Rail for Railroad Curves.—1842.

NERNST LAMP COMPANY.

Incandescent Lamp.—1906.

NICHOLS, H. B., AND VOYNOW, C. B.

Cast Zinc Joint for Rail-Bonding.—1906.

OLDS, CALVIN.

Planting Machine.—1840.

ORUM, MORRIS L.

Improved Lock.—1885.

ORUM, MORRIS L.

Mandrel for Bending Metal Pipes.—1875.

OTIS, SIDNEY; SMITH, R. C.; IHLDER, J. D.; SUNDH, AUGUST.

Electric Elevator.—1902.

OUTERBRIDGE, A. E., JR.

Method of Carbonizing Fabrics and Castings Therefrom.—1888.

OUTERBRIDGE, A. E., JR.

Method for Investigating the Molecular Physics of Cast Iron.—1897.

PAAROWDAKI, SPIRIDION, AND BLONDEL, ANDRE.

Holophone Globes.—1898.

PALMER, B. F.

Artificial Leg.—1849.

PALMER, FREDERICK; REYNOLDS, J. R.; TIRRELL, J. P.

Engine Stop and Speed Limit System.—1906.

PARKER, ZEBULON.

Water Wheel.—1847.

PARKINSON, EDWARD.

Knitting Machine.—1905.

PARSONS, L. H.

Scale Measure.—1852.

PATTERSON, H. G.; PATTERSON, J. G.; CARNEY, T.; COOK, H.

Cash Registers.—1901.

- PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.  
Cash Registers.—1901.
- PAYEN, C.  
Chloride Electrical Storage Battery.—1894.
- PEALE, F.  
Coining Presses at the United States Mint, Philadelphia.—1840.
- PENTZ, A. D.  
Boring and Milling Engine.—1891.
- PERRY, N. W.  
Method of Series Electric Traction.—1894.
- PFATISCHER, MATTHIAS.  
Variable Speed Motors.—1909.
- PHELPS, L. J.  
Induction Telegraph.—1886.
- PHOENIX IRON COMPANY.  
Automatic Cut-Off Steam Engine.—1886.
- PILLINGS, JOHN H., AND MCCALL, THOMAS A.  
Automatic Typewriter.—1917.
- PONTRICHET, J.  
"Heliographic" Paper.—1894.
- POOLE AND COMPANY, J. MORTON.  
Grinding Metallic Calendar Rolls.—1875.
- POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.  
Teleelectric Piano Player.—1910.
- PRATT AND WHITNEY COMPANY.  
Taps and Gauges.—1883.
- PRATT AND WHITNEY COMPANY.  
System of Interchangeable Cut Gears.—1886.
- PRENTISS, H. S.  
Automatic Calendar.—1896.
- PRIESTMAN, W. D. AND SAMUEL.  
Steam Engine.—1894.
- PRUNTY, JOHN E.  
Relief Valve.—1875.
- PRUTZMAN, A.  
Door Lock.—1836.
- REAGAN, J.  
Grate Bars.—1908.
- RECEVEUR, P. N.  
Rose Engine (Lathe).—1853.
- RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.  
Electric Meter.—1893.
- REDDAWAY, FRANK.  
Camel Hair Belting.—1898.
- REED, CHARLES J., AND MCCAULEY, THOMAS.  
Speed-Jack.—1906.

REICHHELM, E. P., AND MACHLET, GEORGE.

Apparatus for Producing Fuel Gases.—1894.

RENO, J. W.

Escalator.—1910.

REYNOLDS, J. R.; PALMER, FREDERICK, S.; TIRRELL, J. P.

Engine Stop and Speed Limit System.—1906.

RHOADS, J.

Map for the Blind.—1840.

RICHARDS, J.

Solder for Aluminum.—1896.

RICHARDS, J.

Balance for Testing White Metal Alloys.—1901.

RICHARDS, T. A.

Ruling Machine.—1890.

RICHARDSON.

Eccentric Door Spring.—1840.

RICHARDSON, J. H.

Signal Lantern.—1868.

RIDGWAY, T. S., JR.

Transit Theodolite.—1839.

RIDGWAY, W. H.

Balanced Crane.—1890.

RIEFLER, SIGMUND.

Mercurial Compensation Pendulum.—1894.

RITCHIE, E. S.

Improved Rhumkorff Coil.—1860.

RITES, F. M.

Perfecting of Shaft Governor System.—1902.

ROEDER, F. A., AND SPRINGER, ALFRED.

Torsion Balance.—1891.

RONDINELLA, L. F.

Photo-Printing Machine.—1905.

ROOT, J. B.

Spiral Weld Tubing.—1890.

ROOTS, P. H. AND F. M.

Rotary Pressure Blower.—1875.

RORER, T. J.

Belting.—1875.

ROSENBAUM, WALTER A.

Automatic Hydraulic Letter Copying Press.—1905.

SACHS, J.

Enclosed Fuse Protective Devices.—1903.

SALOM, PEDRO G., AND MORRIS, HENRY G.

Electric Automobile.—1897.

SARGENT, C. E.

Expansion Gas Engine.—1907.

- SAYEN, H. L.  
Improved Roentgen Ray Tubes.—1898.
- SAXTON, J.  
Reflecting Pyrometer.—1842.
- SCHELLENBACH, WILLIAM S.  
System of Gearing.—1902.
- SCHMIDT, M. E.  
Moving Platform.—1906.
- SCHOOP, MAX ULRICH.  
Metal Spraying Process.—1917.
- SEE, H.  
Hydro-Pneumatic Ash Ejector.—1904.
- SEMPLE, J. B.  
Shell Torch or Tracer.—1905.
- SENNEFF, JACOB.  
Eye-Harness for Metallic Heddle.—1853.
- SEVERY, M. L.  
Printing Machine.—1898.
- SEYMOUR, C.  
Balancer for Pulleys, Fly Wheels, etc.—1878.
- SEXTON, A.  
Slide Rule.—1899.
- SHAW, T.  
Instrument for Testing Ignitable Gases in Mines.—1889.
- SHAW, THOMAS.  
Gunpowder Pile Driver.—1872.
- SHAW, THOMAS.  
Spiral Exhaust Nozzle.—1877.
- SHAW, THOMAS.  
Friction Buffer.—1883.
- SHAY, EPHRAIM.  
Geared Locomotive.—1892.
- SHEDLOCK, ALFRED, AND HANNAY, J. B.  
Lamp for Engineering Uses.—1891.
- SHIMER, P. W.  
Combustion Crucible.—1901.
- SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.  
Typewriter.—1875.
- SHORE, A. F.  
Scleroscope.—1909.
- SHUMAN, F. S.  
Wired Glass.—1894.
- SHUMAN, F.  
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.  
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.  
Typewriter.—1875.

- SPEIDEL, J. G.  
Hoisting Machines.—1891.
- SPELLIER, L. H.  
Electric Clock.—1887.
- SPENCER, J. E., AND FIELD, D. W.  
Damper Regulator.—1893.
- SPERRY, E. A.  
Gyroscope Compass.—1914.
- SPIELMAN, A.  
Cloth Cutting Machine.—1914.
- SPIRO, C.  
Barlock Typewriter.—1894.
- SPRATT, ORLANDS W.  
Mercury Seal Trap.—1885.
- SPRINGER, ALFRED, AND ROEDER, F. A.  
Torsion Balance.—1891.
- SQUIER, G. O., AND CREHORE, A.  
Polarizing Photo-Chronograph.—1896.
- STACKHOUSE, THOMAS H.  
Diagraph.—1895.
- STAHLBERG, C.  
Time Dating Stamp.—1891.
- STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.  
Refrigeration Process.—1894.
- STEINBART, ALFRED, AND UEHLING, EDWARD.  
Pneumatic Pyrometer.—1898.
- STEINBART, ALFRED, AND UEHLING, EDWARD.  
Gas Composimeter.—1899.
- STELLWAGON, H. S.  
Sounding Apparatus.—1848.
- STIERINGER, L.  
Improved Method of Electric Illumination.—1902.
- STREET, CLEMENT F.  
Locomotive Stoker.—1915.
- STRICKLAND, W.  
Substitution of Lime for Salt for Preserving Lumber.—1840.
- SUNDH, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.  
Electric Elevator.—1902.
- SWEETLAND, ERNEST J.  
Filter Press—1918.
- SWENSON, MAGNUS.  
Round Lap Baling Cotton Compress.—1900.
- TABER, HARRIS; LEWIS, WILFRED; MUMFORD, E.  
Molding Machines.—1902.
- TAINTER, SUMMER, AND BELL, CHICHESTER, A.  
Apparatus for Recording Sound.—1900.

TALBOT, E.

Improved Methods in the Manufacture of Steel.—1908.

TATHAM, B., AND BRITTIN, J. W.

Safety Catch for Elevators.—1875.

TATTERSALL, ALFRED R.

Flour Mill.—1917.

TAYLOR, C. M., JR.

Absorption Process for Butter Making.—1903.

TEAL, C. A.

Portable Hoist.—1889.

THOMAS, ALMER, AND MERKET, LUZERNE.

Tempered Copper.—1891.

THOMSON, ELIHU.

Electric Welding.—1889.

THOMSON, ELIHU.

Constant Current Arc Light Transformer.—1901.

THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.

Refrigeration Process.—1894.

THUM, CHARLES D.

Varnish Brushes.—1854.

TIRRILL, A. A.

Voltage Regulator.—1910.

TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.

Engine Stop and Speed Limit System.—1906.

TOWNSEND, ISAAC.

Tent Fastening.—1885.

TWEDDELL, R. H.

Method of Applying Hydraulic Power to Mechanical Work.—1894.

TYLER, PHILOS B.

Shifting Gauge Cock for Steam Boilers.—1835.

TYSON, CHARLES.

Machine to Unite Uppers to the Soles of Shoes.—1875.

UEHLING, EDWARD, AND STEINBART, ALFRED.

Gas Composimeter.—1899.

UEHLING, EDWARD, AND STEINBART, ALFRED.

Pneumatic Pyrometer.—1898.

VAN KANNEL, T.

Storm Door.—1890.

VAUCLAIN, SAMUEL M.

Truck Wheel Centres.—1891.

VILLEROI, M.

Telescope.—1849.

VOYNOW, C. B., AND NICHOLS, H. B.

Cast Zinc Joint for Rail Bonding.—1904.

WAHL, J. C., AND GOLDBERG, H. E.

Adding Machine.—1916.



WAIT, W. B.

Machine for Tangible Writing for Touch Reading.—1900.

WALE, GEORGE AND COMPANY.

Projection Lantern.—1875.

WALSH, E. M. AND SYDNEY B.

Method of Making Large Objects from Pieces of Aventurine.—1902.

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Method of Making Large Objects from Pieces of Aventurine.—1902.

WALTER, L. H.

Method of Detecting Electrical Oscillations.—1907.

WALTER, B.

Electric Switch.—1905.

WEBSTER, W. R.

Apparatus for Observing the Relations between the Chemical Constitution and Ultimate Strength of Steel.—1897.

WEHNELT, A.

Interrupter for Induction Machines.—1905.

WELIN, A.

Life Saving Appliances on Board Ship.—1910.

WESTINGHOUSE, GEORGE, JR.

Railway Car Brake.—1874.

WETZEL, F. J.

Automatic Mechanical Stoker.—1909.

WHARTON, WILLIAM, JR.

Safety Railway Switch.—1873.

WHEELER, S. S.

Electric Fan.—1904.

WHITALL, HENRY.

Planisphere.—1883.

WHITE, O. C.

Adjustable Extension Movement in Ball and Socket Joints.—1889.

WIEDIG, H. P.

Chemical Fire Extinguisher.—1894.

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*Non-resident Members.*—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be enrolled as Non-resident Members, and are required to pay an entrance fee of Five Dollars, and Five Dollars annually. Non-resident Life Membership, \$75.00.

Contributing members, if eligible, under the non-resident clause, on making request therefor, may be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

*Associate Members.*—Associate members are accorded all the privileges of the Institute, except the right to vote or hold office, upon the payment of annual dues of Five Dollars. This class of membership is limited to persons between the ages of seventeen and twenty-five years. Upon reaching the age limit they become eligible to the other classes of membership.

*Resignations must be made in writing, and dues must be paid to the date of resignation.*



- AKIMOFF, NICHOLAS W.**, Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.
- ALBRECHT, A. C.**, Vice President, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, JR.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martins Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier General, U.S.A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM E.**, Clerk, 109 S. 43rd Street, Philadelphia, Pennsylvania.
- ALLEN, WILLIAM N.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L.**, Stanford University, California.
- AMES, Dr. JOSEPH S.**, Director Physical Laboratory, The John Hopkins University, Baltimore, Maryland.
- ANDERSON, OLAF**, Geologist, Mineralogical Institute, Kristiania, Norway.
- ANDERSON FRANK**, Mining Engineer, 468 12th-East Street, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U.S.A., Electrical Engineer, Address unknown.
- ANDERSON, ROBERT J.**, Metallurgical Engineer, U.S. Bureau of Mines, Experiment Station, Pittsburgh, Pennsylvania.
- ANDREAU, ROLAND L.**, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR**, Vice-President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- APPELBAUM, ALAN I.**, Chemist, P. O. Box 808, Trenton, New Jersey.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ARNY, H. V.**, Professor of Chemistry, 115 West 68th Street, New York City, New York.
- ASEF, Dr. WALDEMAR**, Research Chemist, Research Department, Pennsylvania Salt Manufacturing Company, Greenwich Point, Philadelphia, Pennsylvania.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN**, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHMEAD, FRANK M.**, Civil Engineer, 816 Ivy Street, Pittsburgh, Pennsylvania.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, Box 173, Beckley, West Virginia.
- ATTERBURY, W. W.**, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M. Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L.**, Vice Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE, E.**, Sharples Specialty Company, West Chester, Pennsylvania.
- BACHE, DANIEL T.**, Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemist Director, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pennsylvania.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, JR.**, Manufacturer, Wayne Avenue and Hortter Street, Germantown, Philadelphia, Pennsylvania.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S.**, Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, A. STUART**, Chief Engineer, Illinois Central Railroad Company, Chicago, Illinois.
- BALDWIN, FREDERIC E.**, (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.
- BALLARD, JUDSON T.**, Chemist, 1010 Chelton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM I.**, Vice President, Advance Rumely Company, La Porte, Indiana.
- BALLINGER, WALTER F.**, Architect, Twelfth and Chestnut Streets, Philadelphia, Pennsylvania.



- BIDDLE, JAMES G.**, Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-56 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 1011 Mutual Life Building, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, Lieutenant Commander, A. W. K.**, Civil, Mechanical and Electrical Engineer, Apartado 570, Barcelona, Spain.
- BILLOW, CLAYTON O.**, Consulting Engineer, 6800 Sheridan Road, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 E. Broadway Street, Portland, Oregon.
- BINDER, RICHARD L.**, President, K. & B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINNS, ARTHUR W.**, Steam Engineer, 1929 Poplar Street, Philadelphia, Pennsylvania.
- BIRCH, GEORGE W., JR.**, Chemist, 1414 East Columbia Avenue, Philadelphia, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 5905 York Road, Baltimore Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 207 South 39th Street, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLAKELEY, ABRAHAM G.**, Chief Chemist, Philadelphia and Reading Coal and Iron Company, Pottsville, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
- BODINE, SAMUEL T.**, President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEHMKE, Dr. RODRICH**, Manufacturing Optician, 827 Spring Garden Street, Philadelphia, Pennsylvania.
- BOEKEL, J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.** (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J.**, Metallurgist, Secretary, Primos Chemical Company, and for mail, Merion, Pennsylvania.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORGNER, CYRUS**, Manufacturer of Fire Brick and Clay Retorts, 234 North 23rd Street, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, JR.**, Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
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 AGNEW, JOHN, 1831-1850, 1852-1854  
 ALLEMAN, GELLERT, 1918-  
 ALLEN, JAMES, 1845  
 ALLISON, WILLIAM C., 1863  
 ARCHER, ELLIS S., 1858-1859  
 BACHE, ALEX. DALLAS, 1830-1839  
 BALCH, EDWIN S., 1902-1912  
 BALDWIN, MATTHIAS W., 1827-1854  
 BANES, CHARLES H., 1877-1885,  
 1887-1895  
 BARKER, GEORGE F., 1874-1875  
 BARRAS, JOSEPH J., 1851-1860  
 BARTOL, BARNABAS H., 1863-1865  
 BARTOL, HENRY W., 1870-1878  
 BAUGH, DANIEL, 1900-1902

BAUGH, HARMAN, 1855  
 BEALE, JOSEPH, 1827  
 BEARDSLEY, ARTHUR, 1894-1902  
 BECK, PAUL, JR., 1824-1825  
 BEMENT, CLARENCE S., 1871  
 BEMENT, WILLIAM B., 1866-1870  
 BERGNER, THEODORE, 1870-1875  
 BETTS, WILLIAM C., 1844  
 BIDDLE, CLEMENT C., 1824  
 BILGRAM, HUGO, 1885-1890  
 BIRKBECK, JOHN, 1869-1871  
 BIRKINBINE, HENRY P. M., 1851-1856  
 BIRKINBINE, JOHN, 1907-1915  
 BOLTON, JAMES M., 1830  
 BONINE, CHARLES E., 1921-  
 BORGNER, CYRUS, 1903-1907  
 BOSWELL, WILLIAM L., 1896-1898  
 BOWER, HENRY, 1891-1896



**MANAGERS—(Continued)**

- GRAFF, FREDERICK**, 1852-1854, 1858-1865, 1880-1881  
**GREBLE, EDWIN**, 1841-1863  
**GREENE, STEPHEN**, 1898-1908  
**GRIES, JOHN M.**, 1858-1862  
**GRIFFITH, R. EGGLESFIELD**, 1870-1871  
**GRIFFITH, ROBERT E.**, 1827  
**GROVES, DANIEL**, 1824-1827  
**HALL, CLARENCE A.**, 1922-  
**HAND, JAMES C.**, 1845-1846  
**HANSELL, WILLIAM S.**, 1827  
**HARDING, GEORGE**, 1864-1865  
**HARKER, JOSHUA G.**, 1831-1836  
**HARPER, JAMES**, 1824-1826  
**HARRIS, WILLIAM**, 1860-1863  
**HARRISON, ALFRED C.**, 1895-  
**HARRISON, C. LELAND**, 1899-1902  
**HARRISON, JOHN**, 1824-1829  
**HARRISON, JOSEPH, JR.**, 1854, 1856-1859  
**HART, SAMUEL**, 1865-1870  
**HAVILAND, JOHN**, 1824-1826  
**HAYS, ISAAC**, 1840-1841  
**HAYWARD, NATHAN**, 1917-  
**HELLER, CHARLES S.**, 1879-1880  
**HELME, WILLIAM**, 1869-1888  
**HENDERSON, GEORGE R.**, 1915-1921  
**HERSE, GEORGE P.**, 1851  
**HEXAMER, CHARLES A.**, 1904-  
**HEYL, HENRY R.**, 1879-1895, 1898-1909  
**HOADLEY, GEORGE A.**, 1911-  
**HORN, HENRY**, 1824  
**HORSTMANN, WILLIAM J.**, 1865-1868  
**HOUSTON, EDWIN J.**, 1874-1897  
**HOWARD, GEORGE C.**, 1855-1858  
**HOWE, HERBERT M.**, 1898-1900  
**HOWSON, CHARLES HENRY**, 1903-1907  
**HOWSON, HENRY**, 1898-1903  
**HUFTY, SAMUEL**, 1834-1850  
**HUMPHREYS, SAMUEL**, 1826  
**HUNTER, JAMES**, 1864  
**HUTCHINSON, CHARLES H.**, 1888-1890  
**HUTCHINSON, JAMES**, 1841-1842  
**HUTCHINSON, JOSEPH**, 1860-1863  
**JAYNE, HARRY W.**, 1891-1910  
**JENNINGS, W. N.**, 1896  
**JOHNSON, LAWRENCE**, 1855-1859  
**JONES, THOMAS P.**, 1826  
**JONES, WASHINGTON**, 1859-1895, 1897-1900  
**KATEZ, I.**, 1824  
**KEATING, WILLIAM H.**, 1824-1826, 1830-1840  
**KELLER, HARRY F.**, 1914-  
**KELLY, HENRY H.**, 1851  
**KING, ROBERT P.**, 1851  
**KIRK, CHARLES H.**, 1830  
**KIRKPATRICK, GEORGE E.**, 1911-1914  
**KNEASS, WILLIAM**, 1825  
**KNIGHT, DANIEL R.**, 1845  
**KRUMBHAAR, ALEXANDER**, 1898-1911  
**KUHN, C. HARTMAN**, 1896-1905  
**LAMBERT, WM. H.**, 1906  
**LESLEY, ROBERT W.**, 1913-  
**LE VAN, W. BARNET**, 1864-1876  
**LEVY, LOUIS E.**, 1903-1915  
**LEWIS, ENOCH**, 1868-1894  
**LEWIS, HARVEY**, 1824-1827  
**LEWIS, MORDECAI D.**, 1828-1836  
**LINDSAY, JOHN**, 1843  
**LINDSAY, ROBERT**, 1834-1836  
**LINNARD, JAMES M.**, 1836-1838  
**LINVILLE, J. HAYES**, 1868  
**LONGSTRETH, CHARLES**, 1903-1907  
**LONGSTRETH, EDWARD**, 1868-1870, 1895-1897  
**LOUD, THOMAS**, 1829-1831  
**LOVE, WILLIAM H.**, 1859  
**LUCAS, JOHN**, 1888-1894  
**LUKENS, ISAIAH**, 1828  
**LUKENS, JAWOOD**, 1902-1908  
**LYMAN, BENJAMIN S.**, 1901-1902  
**MCALPINE, JAMES**, 1825-1828  
**MCCAFFREY, E. V.**, 1910-  
**MCCAMBRIDGE, RICHARD**, 1876  
**MCCLURE, JOHN**, 1853-1856  
**MCCLURG, ALEXANDER**, 1833-1839

## MANAGERS—(Continued)

- McEuen, Thomas, 1829  
 McKean, William V., 1879-1883  
 Marks, William D., 1881-1884  
 Marshall, Samuel R., 1887-1893  
 Mason, David H., 1824  
 Mason, James S., 1861  
 Megargee, Charles, 1858  
 Meirs, Richard Waln, 1908-1917  
 Merrick, J. Vaughan, 1864-1866,  
 1870-1884  
 Merrick, Samuel V., 1824-1827,  
 1830-1841, 1855-1863  
 Mifflin, Lloyd, 1825-1826  
 Miles, Frederick B., 1874  
 Miller, Abraham, 1824-1846, 1855-  
 1858  
 Mitchell, J. E., 1874  
 Mitchell, William A., 1864-1865  
 Morris, Isaac P., 1836-1843  
 Moore, Bloomfield H., 1864-1868  
 Moore, Joseph W., 1860-1861  
 Morgan, Marshall S., 1914-  
 Morris, Elwood, 1844-1847  
 Morris, Henry G., 1864-1869  
 Morris, William E., 1847-1851  
 Muckle, M. Richards, Jr., 1894-1896  
 Naylor, Jacob, 1863, 1865-1872  
 Neafie, Jacob G., 1868  
 Newhall, Paul W., 1843-1844  
 Norris, Isaac, 1870-1878, 1883-1918.  
 Nystrom, John W., 1873-1875  
 Ogden, John M., 1833  
 Ogle, Williams, 1845-1850  
 O'Neill, John, 1827-1832  
 Orr, Hector, 1871-1887  
 Outerbridge, Alex. E., Jr., 1881-1886  
 Palmer, B. Franklin, 1862  
 Parrish, William D., 1838, 1852-  
 1854  
 Parry, Charles T., 1864  
 Patterson, Robert, 1824  
 Patterson, Robert M., 1825-1827  
 Paul, Lawrence T., 1895-  
 Pemberton, Henry, Jr., 1891-1896  
 Perry, Robert S., 1912-1916  
 Pettit, Horace, 1894-1910  
 Purves, Alexander, 1875-1876  
 Ralston, Ashbel G., 1825-1830  
 Ramage, Adam, 1824-1832  
 Rand, Theodore D., 1874-1897  
 Reed, William B., 1832-1836  
 Reeves, Benjamin, 1829-1837  
 Reeves, Samuel J., 1864  
 Reeves, Stacy, 1889-1902  
 Rice, John, 1866-1867  
 Richards, Mark, 1831  
 Richardson, John, 1825  
 Riehle, Henry J., 1826-1827  
 Robbins, Samuel J., 1827-1833  
 Roberts, Algernon S., 1828  
 Roberts, Percival, 1864-1868  
 Roberts, Solomon W., 1842-1847  
 Robinson, Alexander P., 1911-1916  
 Rogers, Evans, 1854-1863  
 Rogers, Henry D., 1838-1843  
 Rogers, James S., 1909-  
 Rogers, Robert E., 1867  
 Ronaldson, Charles E., 1885-1893,  
 1908-1912  
 Rosengarten, George D., 1912-  
 Rowland, James, Jr., 1829-1830  
 Rowland, William, 1828  
 Rush, William, 1825  
 Rust, James I., 1824  
 Sadtler, Samuel P., 1888-1897  
 Sanborn, E. H., 1907-  
 Sertain, John, 1877-1879  
 Sertain, Samuel, 1865-1882  
 Savery, Peleg B., 1851-1852  
 Saxton, Joseph, 1842-1844  
 Say, Benjamin, 1832-1833  
 Scattergood, Thomas, 1829-1834  
 Schaum, Otto W., 1907  
 Schreiner, Joseph H., 1827-1832

**MANAGERS—(Continued)**

- SCHUMANN, FRANCIS, 1899-1902  
 SEIPER, THOMAS, 1824  
 SELLERS, COLEMAN, 1862-1866, 1875-1905  
 SELLERS, COLEMAN, JR., 1906-1911  
 SELLERS, WILLIAM, 1857-1861, 1867-1892  
 SHAIN, CHARLES J., 1884-1887  
 SHINN, EARLE, 1836-1837  
 SLOAN, SAMUEL, 1864  
 SMITH, CHARLES E., 1852-1855  
 SMITH, HASELTINE, 1922-  
 SOUDER, JACOB, 1828  
 SPANGLER, HENRY W., 1891-1893  
 STEVENSON, WILLIAM, JR., 1828  
 STEWART, THOMAS S., 1842-1850, 1852-1863  
 STRICKLAND, WILLIAM, 1828  
 STRUTHERS, JOHN, 1827-1849  
 TABER, GEORGE, 1839-1842  
 TATHAM, WILLIAM P., 1870-1878, 1886-1887  
 THOMPSON, AMBROSE W., 1839-1843  
 THOMSON, ELIHU, 1878-1881  
 THORNE, WILLIAM H., 1881-1897  
 THORNLEY, JOHN, 1851  
 TILGHMAN, BENJ. C., 1871-1875  
 TOPPAN, CHARLES, 1831-1832  
 TOWNE, JOHN H., 1840-1857, 1869  
 TOWNSEND, EDWARD Y., 1866-1867  
 TRACY, ELIASHIB, 1851  
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857  
 TRAUTWINE, JOHN C., JR., 1891-1895  
 TREGO, CHARLES B., 1837-1846  
 TREVOR, JOHN B., 1832  
 TROTH, HENRY, 1837-1841  
 TRYSON, GEORGE W., 1831-1833  
 TUTWILER, C. C., 1920-  
 TYLER, RUFUS, 1826-1837  
 VAUCLAIN, SAMUEL M., 1898, 1906  
 VAUX, GEORGE, JR., 1898-1899  
 WALTER, JOSEPH S., JR., 1834-1837  
 WALTER, THOMAS U., 1829-1831, 1840-1851  
 WARDER, WILLIAM S., 1825-1827  
 WARNER, JOHN S., 1837-1843  
 WEAVER, JACOB, 1856-1857  
 WEAVER, JOHN J., 1880-1891  
 WEIGHTMAN, WILLIAM, 1862-1863  
 WETHERILL, CHARLES, 1835  
 WETHERILL, J. P., 1902  
 WETHERILL, JOHN P., 1824-1825  
 WETHERILL, WILLIAM, 1832  
 WETHERILL, WILLIAM C., 1916-  
 WEYGANDT, THOMAS J., 1851-1863  
 WHARTON, WILLIAM, JR., 1871  
 WHITAKER, GEORGE P., 1851-1852  
 WHITE, CHARLES H., 1828-1835  
 WHITE, SAMUEL S., 1864-1867  
 WHITNEY, ASA, 1846-1850  
 WHITNEY, GEORGE, 1858-1860  
 WHITNEY, JAMES S., 1862-1863, 1865-1869  
 WHITNEY, JOHN R., 1861  
 WICKHAM, M. T., 1824  
 WIEGAND, JOHN, 1831-1853  
 WIEGAND, S. LLOYD, 1864, 1890-1893  
 WILLIAMS, EDWARD H., 1871-1872  
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863  
 WILSON, JOSEPH M., 1869-1886  
 WILSON, O. HOWARD, 1864-1869  
 WOLBORN, CORNELIUS A., 1844-1850  
 WOLF, OTTO C., 1897-1913  
 WOOD, ALAN, 1845-1863  
 WOOD, SAMUEL R., 1824-1825  
 WOOD, WALTER, 1903-1912  
 WOOTTEN, JOHN E., 1860-1862  
 YARDLEY, WILLIAM, JR., 1829  
 YEAGER, JOSEPH, 1832  
 YOUNG, ANDREW, 1828-1830

## PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS

1834-1922

BACHE, ALEXANDER D., 1834-1836, 1839-1844	KOENIG, G. A., 1888-1889
BARNES, JAMES, 1922-	LEVY, LOUIS E., 1901-1902
BEARDSLEY, ARTHUR, 1892-1895	LEWIS, WILFRED, 1912-1913
BILGRAM, HUGO, 1906-1907	MARBURG, EDGAR, 1899-1900
BONINE, CHARLES E., 1916-1917	MARKS, W. D., 1881-1882, 1887-1888
CHRISTIE, JAMES, 1897-1898	MASLAND, CHARLES W. 1921-1922
CLAMER, G. H., 1915-1916	MCCONNELL, JACOB Y., 1909-1910
CONARD, THOMAS P., 1902-1903	ORR, HECTOR, 1880-1881
CREIGHTON, H. JERMAIN, 1918-1919	PATTERSON, R. M., 1836-1839
CRESSON, J. C., 1844-1874	PENROSE, CHARLES, 1920-1921
CRISFIELD, J. A. P., 1913-1914	ROGERS, JAMES S., 1908-1909
ELDRIDGE, G. MORGAN, 1896-1897	RONALDSON, CHARLES E., 1903-1904
FRANKLIN, BENJAMIN, 1919-1920	RONDINELLA, L. F., 1898-1899
GOLDSMITH, EDWARD 1905-1906	SARTAIN, SAMUEL, 1895-1896
GRIGGS, WILLIAM O., 1907-1908	SELLERS, COLEMAN, 1875-1880
HAUPT, LEWIS M., 1904-1905	SPANGLER, H. W., 1890-1891
HENDERSON, GEORGE R., 1914-1915	SPENCER, THOMAS, 1910-1911
HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901	WETHERILL, WM. CHATTIN, 1917-1918
HOADLEY, GEORGE A., 1911-1912	WIEGAND S. LLOYD, 1889-1890, 1891- 1892



## **THE INSTITUTE'S ACTIVITIES**

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**THE FRANKLIN INSTITUTE** was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

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### **THE LIBRARY**

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room;" and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the **JOURNAL**, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.



## YEAR BOOK OF

~~Organization~~ continued in existence until the year 1834, when, by ~~the~~ ~~action of the Institute~~, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a ~~greater~~ ~~kind of labor~~. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to add their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years and its usefulness during this long period is attested by its reports containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

## THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.



This committee was appointed on March 4, 1824 and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. With the organization of the public high school, that of the Institute was abandoned as unnecessary. The drawing school, however, was continued, and has maintained an uninterrupted existence to the present. Its leading feature—that of training pupils for actual work in shop and office—has always been rigorously preserved, and at the present time, as a school for mechanical draughtsmen, it is conceded, by those best qualified to judge, to be one of the most thorough and practical of any in the country.

Twenty-three years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and are now known as the School of Mechanic Arts.

## LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction



Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.





1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

1869. Resolutions passed by the meeting in August and addressed to Congress suggested an exhibition to commemorate the hundredth anniversary of the United States and resulted in the holding of the Centennial Exhibition of 1876.

Solar Eclipse Expedition to Iowa in August, Dr. Henry Morton, Director. The services of the observers were gratuitous, the instruments were borrowed and the transportation for the party and equipment was furnished by the railroads.

1872. Committee on the mode of determining the horsepower of steam boilers published its report.

1873. The Institute approved Professor Lesley's recommendation of a more thorough Geological Survey of Pennsylvania, and asked the Legislature



1897. A communication from the Board of Health of the City of Philadelphia requested the Institute to appoint a committee to confer with the Board of Health with a view of taking action to abate or modify the smoke nuisance. A full report appeared in the JOURNAL.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

1901. Resolutions passed to promote commerce by the improvement of waterways and approving the creation of the Department of Commerce.

1902. The metric system fully discussed at the monthly meetings. Resolutions passed petitioning the national government to enact such laws as will ensure its proper use.

1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army.

Established School of Navigation for the United States Shipping Board.

Conducted Free Radio School for men of the selective draft.

1920. Published "The Physics of the Air" by W. J. Humphreys, C.E., Ph.D.

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The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.



This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

## THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.





This committee was appointed on March 4, 1824 and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. With the organization of the public high school, that of the Institute was abandoned as unnecessary. The drawing school, however, was continued, and has maintained an uninterrupted existence to the present. Its leading feature—that of training pupils for actual work in shop and office—has always been rigorously preserved, and at the present time, as a school for mechanical draughtsmen, it is conceded, by those best qualified to judge, to be one of the most thorough and practical of any in the country.

Twenty-three years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and are now known as the School of Mechanic Arts.

## LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction



Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.



1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

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1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army.

Established School of Navigation for the United States Shipping Board.

Conducted Free Radio School for men of the selective draft.

1920. Published "The Physics of the Air" by W. J. Humphreys, C.E., Ph.D.



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said officers shall be elected at an annual meeting of the said corporation, to be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created; and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

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An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.





shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

## BY-LAWS OF THE INSTITUTE

### ARTICLE I.—*Trustees.*

SECTION 1. All Real and Personal Estate of the Institute which may hereafter be acquired by voluntary subscription or devise, bequest, donation, or in any way other than through its own earnings or by investment of its own funds, saving where the donors shall expressly provide to the contrary, shall be taken as acquired upon the condition that the same shall be vested in a Board of Trustees, who shall be appointed in the manner hereinafter indicated. Unless the title to such property shall be directly vested in said Board of Trustees by the donors, the Institute, by deed attested by the President and Secretary, which they are hereby authorized to execute and deliver, shall forthwith convey the same to said Trustees, who shall hold it in trust for the purposes specifically designated by the donors; or, if there shall be no specific designation, for the benefit of the Institute in the way and manner hereinafter provided, so that the same shall not, in any event, be liable for the debts of the Institute.

SEC. 2. Said Board of Trustees shall be composed of seven (7) members, originally elected by the Board of Managers on its own nomination.

Vacancies, as they occur, shall be filled by election by the Board of Managers from nominations made by the remaining Trustees to a stated meeting of the Board of Managers at least one month prior to the election; the Board of Managers to have the right to reject any nominations not satisfactory to them.

The remaining members of the Board of Trustees, whenever at any time it shall be deemed necessary to do so, shall have power to assign and convey the property held by them, so as to vest the title thereto in themselves and their successors.

SEC. 3. Said Trustees shall have full power and authority, from time to time, to assign, sell and dispose of any property, real and personal, by them held, unless there shall be some direction by the donors to the contrary, and shall have power to convey the same without purchasers being obliged to see to the application of the purchase moneys, when authorized so to do by a



*Second Class.*—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefor, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; *provided*, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Actuary, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

SEC. 9. The shares of stock obtained by the Institute by legacies, donations, or forfeiture shall at once be cancelled.

### ARTICLE III.—*Members.*

SEC. 1. The members of the Institute shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and they may be either annual contributors, associate members, life members, permanent members, holders of Second Class stock, honorary or corresponding members.

SEC. 2. The privileges of membership, other than associate membership, in the Institute shall extend only to persons of legal age who are not in arrears and who shall have signed the Charter and By-Laws.

SEC. 3. Annual contributors shall pay yearly dues of Fifteen Dollars; shall be entitled to all of the privileges of the Institute, and shall be eligible to any office or to membership upon any committee.



again notified, and if such dues become one year in arrears, the said member shall by that fact forfeit all connection with the Institute. The Board of Managers, however, may, for cause by it deemed sufficient, extend the time for payment and for the application of these penalties.

The Board of Managers may, for sufficient cause, temporarily excuse from payment of annual dues any member who from ill health, advanced age or other good reason assigned, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. The annual dues from contributing members may be applied to the current expenses of the Institute, but all moneys received from life and permanent membership shall be vested in the Board of Trustees, the income therefrom only to be applied to the maintenance fund.

#### ARTICLE V.—*Officers.*

The officers shall be a President, three Vice-Presidents, a Secretary, a Treasurer, and twenty-five Managers. A majority of the Managers shall be persons directly interested in industrial pursuits.

#### ARTICLE VI.—*Election of Officers.*

SECTION 1. An election for officers shall be held on the third Wednesday in January in each year. At this election the President and the Treasurer shall be elected to serve one year, and one Vice-President, and eight Managers, shall be elected to serve for three years; *provided*, that the officers now elected or who may hereafter be elected, shall continue to serve until their successors be elected.

One Manager, to be known as the Alumni Manager, shall be elected in January of every third year, beginning in the year 1910, by the Alumni Association of the Institute, to serve for three years. A vacancy in this position shall be filled by election in the same manner for the unexpired term.

The Secretary shall be elected by the Board of Managers at their first stated meeting after the annual election each year.

SEC. 2. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy, nor received from a member in arrears.

SEC. 3. Nominations for the annual election for officers shall be presented in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members in good standing, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall promptly be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a



accordance with Section 6 of Article I. He shall also receive all moneys collected for the Institute by the Actuary. He shall deposit all moneys received, in the name of the corporation, in such institution as the Board of Managers may direct. He shall make no payments without written vouchers from the Board of Managers. He shall keep accurate accounts of the income and disbursements of the Institute, exhibit an accurate statement of his receipts and payments at each stated meeting of the Board of Managers, and of the condition of the finances of the Institute whenever called on by them, and shall make an annual statement thereof at the annual meeting of the Institute. He shall give bonds to an amount fixed by the Board of Managers for the faithful performance of his trust. In case of a vacancy in the office of treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position *pro tempore*.

#### ARTICLE X.—*Board of Managers.*

SECTION 1. The Board of Managers shall consist of 25 members elected as provided in Article VI; all officers of the Institute, *ex officio*, except the Trustees; and the Chairman of the Committee on Science and the Arts' *ex officio*.

The Board of Managers shall have entire charge and control of the current receipts and expenditures of the Institute, and of all its business affairs not specially reserved to the Board of Trustees, and shall have authority to do all acts not inconsistent with the rights and duties of the Trustees which may in their judgment advance the interests of the Institute.

They shall have authority, by exchange, sale or otherwise, to add to or subtract from the collections of books, furniture and apparatus, in such manner, however, that the aggregate value of the same to the Institute, at any time, may not be impaired.

They shall have authority to elect members of the Institute, except Honorary and Corresponding Members, who shall be elected by the Institute.

SEC. 2. They shall keep regular minutes of their proceedings, which shall be open at all times to inspection by members of the Institute.

SEC. 3. They shall present, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 4. They shall hold stated meetings once in each month. They shall elect their own officers, except the chairman, who shall be the President of the Institute, or in his absence, as provided for in Article VII, and shall be at liberty to make by-laws for their own regulation not inconsistent with the Charter, or with the By-Laws of the Institute. Seven of their members shall constitute a quorum.

SEC. 5. All vacancies in the Board of Managers shall be filled by an election at the next stated meeting of the Institute.

#### ARTICLE XI.—*Audits.*

The accounts of the Treasurer and Board of Trustees shall be audited





Final action on a report conferring or recommending an award shall not be taken by the General Committee except at the second or two successive stated meetings at which it has been read and been open for discussion and amendment.

A quorum for final action upon a report conferring or recommending an award shall consist of not less than fifteen members, and when such report is adopted it shall be accepted as the decision of the Institute.

Reports when issued after final adoption shall set forth that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be signed by the President and the Secretary of the Institute and by the Chairman of the Committee; and the seal of the Institute shall be affixed thereto. The Committee may provide that such reports shall also be signed by the members of the respective sub-committees who made the investigations and prepared the reports.

The Chairman of the Committee shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require.

He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

At the request of the Committee on Publications, and to make an adopted report more suitable for use in the JOURNAL of the Institute, the sub-committee that prepared the report shall have authority to amplify or abridge it without in any way changing its meaning or recommendation for award; but the fact of such modification must be stated as a note at the beginning of its publication in the JOURNAL.

SEC. 3. Each committee named in the first and second sections shall choose a chairman at its first meeting after its appointment.

Record of their proceedings shall be kept by the Secretary. They shall report to the Institute, and when required to the Board of Managers.

They shall be governed by such rules, not inconsistent with these By-Laws, as may be adopted by them respectively.

The Committees on the Library, on Meetings, and on Science and the Arts, shall meet at least once in each month, except in July and August.

SEC. 4. No bills for expenses incurred by committees shall be paid unless approved by the Committees which incurred them.

#### ARTICLE XIII.—*Meetings.*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.



shall be the duty of the Committee on Sectional Arrangements to inform the Board of Managers, which may thereupon declare that such section is extinct.

SEC. 4. All members of the Institute shall have the privilege of enrolling themselves, without payment of additional fees, as members of any of the sections which are now, or which may hereafter be, established in conformity with these By-Laws, and such enrollments shall be reported from month to month to the secretaries of the sections designated; but no person shall be entitled to any of the privileges of any of the sections who has not complied with the condition of Article III of these By-Laws.

SEC. 5. Each section shall submit to the Committee on Sectional Arrangements prior to the stated meeting of the Board of Managers in December of each year, an estimate of moneys it will require for the ensuing year, and such estimate the Committee on Sectional Arrangements shall transmit, with its recommendation, to the Board at its stated meeting in December.

SEC. 6. Each section shall elect its own officers and make its own by-laws, not inconsistent with the Charter and By-Laws of the Institute. The Institute shall not be responsible for bills contracted by any section in conformity with the conditions prescribed in Section 4 of Article XII of the By-Laws relating to committees, nor in any event for a sum greater in any one year than the amount appropriated by the Board of Managers for the service of the section for that year.

SEC. 7. All requisitions for supplies shall be made by order upon the Actuary of the Institute.

SEC. 8. The books, papers, apparatus, specimens, models, and all other collections of each section, shall be the property of the Institute, held for the use of that section. Donations of objects or books to or for any section, shall be received and reported to the Committee on Sectional Arrangements, and by this committee to the Board of Managers, as donations to the Institute for the use of that section.

SEC. 9. Each section shall determine, subject to the approval of the Board of Managers, the times of its stated meetings.

SEC. 10. Papers read and lectures delivered before any section and approved by the same, shall be referred to the Committee on Publications of the Institute, and if accepted by them, shall be published in the JOURNAL of the Institute.

SEC. 11. Societies now existing, or which may hereafter be founded, for the consideration of any subjects clearly within the scope of The Franklin Institute, and which societies may desire to unite with The Franklin Institute as sections, shall furnish a list of such of their members as have declared their willingness to become members of the Institute, to the Committee on Sectional Arrangements, which committee shall transmit the same, with its recommendation, to the Board of Managers.

SEC. 12. On all points not herein provided for, each section shall be governed by the Charter, By-Laws and usages of the Institute.





event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

**The Certificate of Merit.**—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

**The Boyden Premium** (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

### HISTORY OF THE MEDALS.

**The Franklin Medal.**—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award, on the average, two Franklin Medals a year. Though this would leave little surplus, he inserted the sixth condition to prevent an undesirable accumulation of the fund.



4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,  
*President.*

[SEAL]

R. B. OWENS,  
*Secretary.*

**The Elliott Cresson Medal.**—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and





1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

**The Certificate of Merit.**—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

*"Resolved*, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to \_\_\_\_\_ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

Report No. \_\_\_\_\_ Approved, \_\_\_\_\_ 19 \_\_\_\_\_

\_\_\_\_\_ *President.*

[SEAL]

\_\_\_\_\_ *Secretary.*

\_\_\_\_\_  
*Chairman of the Committee on Science and the Arts.'*"

**The Boyden Premium.**—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of  $2 \times 10^{14}$  double vibrations per second in the infra-red and  $8 \times 10^{14}$  in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.



4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

### ARTICLE III.—*Chairman.*

SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees on investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

### ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The



**SEC. 6. Resignations.**—All resignations by members of the Board, after acceptance thereof, shall be reported to the Institute at its next stated meeting.

Members who have not attended six regular meetings prior to the stated meeting of the Institute in December, shall be reported thereat as having resigned, unless it be unanimously voted by the Board, at its stated meeting in December, that such member has been absent for sufficient reason.

**SEC. 7. Standing Committees.**—The following Standing Committees, consisting of five members each, shall be appointed by the President and approved by the Board:

1. On Instruction. 2. On Election and Resignation of Members. 3. On Stocks and Finance. 4. On Publications. 5. On Exhibitions. 6. On Sectional Arrangements. 7. On Endowment. 8. Executive.

It shall be the duty of the Executive Committee to make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

It shall be the duty of all the committees to keep regular minutes of their proceedings, and report monthly to the Board, and to report through the Committee on Stocks and Finance to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

**SEC. 8. Professorships.**—The Board may, at its discretion, establish such Professorships as may seem advisable, and on such subjects as it may designate, to serve until the next succeeding first meeting after the annual meeting.

**SEC. 9. Order of Business.**—The order at the stated meetings shall be as follows:

1. Calling the roll.
2. Reading the minutes and acting thereon.
3. Report from Treasurer, and action on bills.
4. Report from Standing Committees, and action thereon
  - (a) On Instruction.
  - (b) On Election and Resignation of Members.
  - (c) On Stocks and Finance.
  - (d) On Publications.
  - (e) On Exhibitions.
  - (f) On Sectional Arrangements.
  - (g) On Endowment.
  - (h) Executive.
5. Reports from Special Committees and action thereon.
6. Deferred Business.
7. New Business.

**SEC. 10. Amendments.**—These By-Laws may be altered at any stated meeting of the Board, provided the alteration be approved by two-thirds of the members present.



event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

**The Certificate of Merit.**—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

**The Boyden Premium** (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

### HISTORY OF THE MEDALS.

**The Franklin Medal.**—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award, on the average, two Franklin Medals a year. Though this would leave little surplus, he inserted the sixth condition to prevent an undesirable accumulation of the fund.





4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,  
*President.*

[SEAL]

R. B. OWENS,  
*Secretary.*

**The Elliott Cresson Medal.**—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and



1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

**The Certificate of Merit.**—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

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Report No. \_\_\_\_\_ Approved, \_\_\_\_\_ 19 \_\_\_\_\_

\_\_\_\_\_ *President.*

[SEAL]

\_\_\_\_\_ *Secretary.*

\_\_\_\_\_  
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The problem has been more specifically defined by the Board of Managers, as follows:

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4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

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SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

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SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

### ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The



SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

#### ARTICLE VI.—*Sub-Committee Meetings.*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

#### ARTICLE VII.—*Sub-Committees' Reports.*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B.





SEC. 12. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Notices of Recommendations.*

SECTION 1. In the case of investigations made upon application, it shall be the duty of the Secretary to certify to applicants the recommendation of the sub-committee within ten days after this recommendation is adopted by the Committee.

ARTICLE IX.—*Reconsideration.*

SECTION 1. Upon the adoption of a report of a sub-committee a motion for reconsideration may not be made before the stated meeting following. If such a motion is then made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

ARTICLE X.—*Advertisement of Recommendations.*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement, or manufacture.

SEC. 2. Upon the adoption by the Committee on Science and the Arts of a report of a sub-committee on investigation setting forth that distinguished work in science or the arts is worthy of an award of the Howard N. Potts Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person who has done such work shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit in the supposed distinguished work in science and the arts.

SEC. 3. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal shall be conclusive without advertisement.



That the Certificate of Merit be awarded for meritorious inventions in physical processes, and JOURNAL contributions of substantial merit but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

#### **REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS**

##### **FORM A**

(Application for Investigation)

#### **THE FRANKLIN INSTITUTE**

**OF THE**

**STATE OF PENNSYLVANIA**

**FOR THE**

**PROMOTION OF THE MECHANIC ARTS**

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled .....

..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B  
(Sub-committee Report Form)  
  
THE FRANKLIN INSTITUTE  
OF THE  
STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....

Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to inevstigate the above subject report as follows:

.....

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... your sub-committee recommends  
the award of ..... to ..... of .....

Respectfully submitted,

..... Chairman.  
.....  
.....  
.....

Adopted at the Stated Meeting of ..... 19 .....

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE  
OF THE  
STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia, .....

S. & A. Case No. ....

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....  
..... reports as follows:

.....

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of .....the Institute awards the .....

.....

to..... of .....

[SEAL] ..... *President.*

..... *Secretary.*

Countersigned .....

*Chairman of the Committee on Science and the Arts.*



## YEAR BOOK OF

The Committee on Publications (Mr. Rosengarten, Chairman) reports, among other interesting data, the publication of the book "Physics of the Air," by H. H. S. Thompson, of the United States Weather Bureau, author. Of this publication 400 copies have been sold, and the demand is still strong. It is a recognized authority and of great value to meteorologists and to the general public. It is a volume also of great interest to the layman. The Committee on Publications also reports a slight, but encouraging, decrease in circulation of the JOURNAL and of the Year Book.

The Committee on Library (Dr. Creighton, Chairman) reports additions to the library of 300 volumes and pamphlets, an increase of 393 titles over the gain of the previous year. The great sugar library bequeathed to the Institute by John D. Warne—about 25,000 volumes and pamphlets—is still in temporary storage in the plant warehouse. As indicated elsewhere in this report, we have the expectation of soon being able to store this valuable collection of books in a building owned by The Franklin Institute.

In the report of the Committee on Instruction (Mr. Paul, Chairman)—which covers the ninety seventh year of our School of Mechanic Arts—we learn that the classes tell off a little, but very little, in numbers from the unusually high enrollment of the previous year. Again we found it necessary to open the school five evenings a week instead of four—our practice prior to 1919—in order comfortably to accommodate the students. The number of students graduated at the class exercises in April—being sixty-nine—is greater than in any previous year in the history of the School.

The Committee on Science and the Arts (Mr. Masland, Chairman) reports 100 cases disposed of during the year and nineteen awards made. This is an unusually large record of disposition of cases and of awards. The report refers to the publication in the 1921 Year Book of a list of all the awards made on recommendation of the Committee since its establishment in 1834. The total of the awards made is 892.

The Committee on Endowment (Mr. Sellers, Chairman) gives some important data relative to the Bartol Bequest, and very interesting information of another bequest so far not reported to you. Mr. George Theodore Roberts, who died in March, 1921, made The Franklin Institute one of the residuary legatees of his large estate, his daughter having a life interest in the property. Mr. Sellers has been advised that the Institute's interest as one of the residuary legatees probably amounts to \$40,000.

The Committee on Stock and Finance (Mr. Forstall, Chairman) reports a very sound financial condition, although for the immediate present our operating expense exceeds our operating revenue. This is a condition anticipated by your Board when we told you a year ago of the then increase in our balance of assets over liabilities, and that at the end of the year, for the first time in memory the Institute would be out of debt, except as between departments. Our work costs more than our regular income affords, but less than our regular income plus the occasional bequests applicable to operating expenses, as over a period of years. In the confidence that this will be a continuing condition we have gone on with our work, spending what was necessary to its efficient conduct,





expect will ultimately occupy the other lots owned by the Institute at this location, will be sufficient to house the Bartol research work and all of the chemical and physical laboratory work of the Committee on Science and the Arts and of all other departments of The Franklin Institute.

The equipment, except for certain standard apparatus that is immediately indicated as necessary, is to be installed gradually as the necessities of the research work in hand indicate. The contribution of the Bartol Research Fund to the cost of the laboratory building is measured by what we estimate it would cost the Committee on the Bartol Bequest to erect a building suitable for its work at a less expensive site. The building being owned by The Franklin Institute, the Bartol Research Bequest will be given a right to use the laboratory in its work for a period that may be definitely fixed or may be unlimited, according as we shall decide later.

The management of the work of the Bartol Research Committee will be in the hands of Dr. R. B. Owens, Director, reporting to the Committee, and with such research professors and fellows as it may be found necessary or important to engage. The sub-committee of Dr. Owens, Chairman; Dr. Joseph S. Ames, and Dr. Arthur L. Day, has been appointed to engage the necessary staff.

The Institute is to be congratulated upon this prospect of soon starting work on a building that will house a portion of its activities, and as we confidently anticipate, will be but the first step toward the construction of a group of buildings, now to be discussed herein.

Your Board thinks it wise at this time, and in this connection to advise you of its hopes and ambitions for the future housing and conduct of the work of the Institute.

The laboratory necessary to the proper housing of the Bartol research work, and of the chemical and physical work of the Committee on Science and the Arts, and of other departments of the Institute, has had reference herein. Our hope is that ultimately this laboratory will be one of a group of three buildings. We look forward to the date of the realization of our hopes and expectations, to see a building at the corner of Nineteenth Street and the Parkway, exteriorly worthy of a place among the noble structures then to be its neighbors and bearing a dignity worthy of the great name it will bear, and interiorly sufficient and suitable to the proper housing and conduct of all the Institute's work and equipment, except that the laboratory and museum are to be otherwise sheltered. The third building of the little group devoted to the promotion of the mechanic arts, when our hopes find fulfilment, will be so-called "Scientific and Technical Museum." In it will be properly arranged and connected for illustration and for operation, the many important models and facsimile apparatus now possessed by the Institute, and the multitude of such other things of interest to a follower of the mechanic arts as we have assurance will come to us when we are prepared properly to care for them. We believe that such a museum has no example in America. The American student, historian, mechanician or inventor, desiring to trace the development of an art through the study of concrete examples, must now journey to Europe to find what we will be able to present to him when our proposed museum is in operation.



## REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

[ABSTRACT.]

*To the President and Members of The Franklin Institute:*

The Committee on Library respectfully submits the statement of activities in the library during the year ending September 30, 1921.

The additions to the library were as follows:

Source	Bound Volumes	Unbound Volumes	Pamphlets
By Gift .....	206	192	1644
Binding .....	390		
Journal .....	52	11	
Purchase:			
Books and Periodicals			
Account .....	4		
Jayne Fund .....	26	2	
Lea Fund .....	29	5	6
Memorial Library Fund	28	4	
Miscellaneous Expense			
Account .....	1	1	1
Moore Fund .....	28	103	3
Morris Fund .....	47	5	3
Periodicals Completion			
Fund .....	1	4	
Potts Fund .....	9	2	
Ware Fund .....	66	28	
	<hr/> 887	<hr/> 357	<hr/> 1657

Total additions for the year .....2901

An increase of 393 titles over the previous year.

The Committee had at its disposal \$1525.00 appropriated by the Board of Managers and \$3359.27, the income from the various trust funds.

The expenditures for the year were \$1131.06 for binding, \$2720.04 for books and subscriptions to magazine and other periodical publications, and \$229.26 for general expenses.

*Donors:*

Gifts of books, pamphlets and magazines in large quantities or of special value were received from Messrs. Hugo Bilgram, Francis T. Chambers, J. A. P. Crisfield, William Forsyth, F. L. Garrison, Max Levy, Lawrence T. Paul; Doctors Carl Hering, Harry F. Keller, Henry Leffmann, the estate of Frederick J. M. Oldach, the Shoemaker-Satterthwaite Bridge Company and the United States Metallic Packing Company.

The contents of the library on September 30, 1921 were as follows:

Volumes, bound and unbound .....	75,912
Pamphlets .....	18,254
Maps and Charts .....	2,292
Photographs .....	1,349

*Binding:*

During the year the following work was done by the binder:

Recent volumes of periodicals .....	350
Recent volumes of foreign chemical periodicals charged to chemical periodical binding fund .....	30
Old volumes, bound and rebound .....	88
	<hr/> 468

*Magazine and Periodical Publications:*

7116 copies of the Journal were used for exchange purposes.

Seven new exchanges were added to the mailing list and fourteen were removed.

Six new subscriptions were ordered and six were discontinued.

The total number of exchanges on September 30th was 586. The subscriptions totaled 130 and the number of gift subscriptions was 73, making the total periodical publications currently received, 789.

*Evening Hours:*

The library was open on meeting nights until ten o'clock, in all, thirty-five evenings.

Respectfully submitted,

H. JERMAIN CREIGHTON,  
*Chairman.*

PHILADELPHIA, January 11, 1922.

## REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

*To the President and Members of The Franklin Institute:*

The following historic models and apparatus have been added to the Institute's collections during the past year:

Air pump of Dr. Joseph Priestley. Presented by Mr. Coleman Sellers, Jr. (An account of Dr. Priestley and his work and a history of this interesting apparatus was prepared by Mr. Sellers and appears in December, 1920 issue of the JOURNAL, Vol. 190, page 877.)

Odometer made by Isaiah Lukens, one of the two first elected vice-presidents of the Institute and Chairman of the Institute's Committee on Inventions. Presented by Mr. Henry R. Towne, of New York City. (A sketch of the life of Isaiah Lukens by Mr. Coleman Sellers, Jr., and a



multiplex operation were considered and a brief historical resume of the invention and early development of this new means of communication given. Current practical engineering methods were discussed, including special applications to hydro-electric power line operation and train dispatching. The subject of attenuation and required power were also treated. Lantern slides were used to illustrate the subject and a working demonstration was given of communication by means of guided wave telephony superimposed upon a physical telephone circuit. Published in the JOURNAL, March, 1921.

The Elliott Cresson Medal was presented to Mr. W. R. L. Emmet for his notable contributions to the art of ship propulsion.

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December 15, 1920: Mr. W. C. White, E.E., Research Laboratory, General Electric Company, Schenectady, New York, presented the paper of the evening entitled "Some Operating Characteristics of Electron Tubes."

"Electron tubes or simply vacuum tubes, as they are most often called, are coming into very general use for quite a wide variety of purposes. Their flexible characteristics and variety of properties also make them very useful in laboratories and for engineering tests and developments. However, in the use of these tubes for special purposes, difficulties are frequently encountered which are due to properties of the tube which are not commonly known or understood." The lecture described a number of these more unusual characteristics, the effects of which, however, are often commonly met with in practice and give experimental difficulty or prevent the correct interpretation of results. The subject was illustrated by lantern slides. The paper was published in the JOURNAL for April, 1921.

January 19, 1921. Annual Meeting of the Institute.

Mr. John W. Lieb, Mechanical Engineer, Vice-president of the New York Edison Company, New York City, New York, member of the Institute, read a paper entitled, "Leonardo da Vinci, Philosopher and Engineer."

The lecture presented a review of the activities of Leonardo da Vinci, as a Philosopher and Engineer, with illustrations and abstracts from his note-books, some of them translated by the lecturer. The review covered Leonardo's work in Military, Civil, Mechanical and Hydraulic Engineering, Aviation, Geology, Anatomy, Optics and many other branches of science, literature and the arts. The lecture revealed Leonardo as one of the greatest intellects of all time, assigning to him an even higher place in philosophy, science and mechanics than he already holds in the history of the graphic arts. The subject was illustrated by numerous lantern photographs of manuscripts and drawings from da Vinci's note-books. The paper appeared in the June and July, 1921 issues of the JOURNAL.

February 16, 1921: Colonel Marston Taylor Bogart, A.B., Ph.B., LL.D., Professor of Organic Chemistry, Columbia University, New York City, New York, presented the paper of the evening entitled, "The Bearing of a Synthetic Dye Industry upon Our National Welfare."





The school opened on September 13, 1920, and during the year four hundred and seventy individual students were enrolled. This was twenty less than the unusually large enrollment of the previous year, but it was necessary to keep the school open five evenings each week instead of four as was previously done in order to accommodate the students comfortably. The largest classes formed during the year were those in First-Year Mechanical Drawing and First-Year Mathematics.

The high grade of work done by the students and their regular attendance indicate that the school has completed one of the most satisfactory years in its history. During the first term, one hundred and six students had a perfect attendance record and forty-nine made an average of ninety per cent. or over. During the second term, one hundred and three students had a perfect attendance record and fifty-nine made an average of ninety per cent. or over.

The Faculty for the year was as follows:

Louis C. Robinson, Director of the School.

Arthur J. Stretton, The Baldwin Locomotive Works, Mechanical Drawing.

I. P. Pedrick, William Sellers & Company, Inc., Mechanical Drawing.

G. W. H. Fawkes, of the University of Pennsylvania Faculty, Mechanical Drawing.

Howard W. Howitz, The Baldwin Locomotive Works, Mechanical Drawing.

Karl E. Klabe, The Baldwin Locomotive Works, Mechanical Drawing and Mathematics.

Clement Remington, Associated with Horace Trumbower, Architect, Architectural Drawing.

John C. Bechtel, of the Germantown High School Faculty, Mathematics.

Frederick C. Miller, of the Germantown High School Faculty, Mathematics.

Harry H. Fox, of the Norristown High School Faculty, Mathematics.

Herbert H. Blizzard, Geo. W. Kendrick 3rd & Company, Mathematics.

W. Earl Neilson, Student at University of Pennsylvania, Mathematics.

Bartram A. Owen, of the University of Pennsylvania Faculty, Mechanics and Structural Design.

B. W. Taylor, of the University of Pennsylvania Faculty, Machine Design.

Joseph W. Thompson, New York Shipbuilding Company, Practical Naval Architecture.

H. Earl Barrett, William Cramp & Sons Ship and Engine Building Company, Theoretical Naval Architecture.

R. E. Brown, New York Shipbuilding Company, Theoretical Naval Architecture.

Albert R. Ware, New York Shipbuilding Company, Practical Naval Architecture.

James G. Morgan, New York Shipbuilding Company, Practical Naval Architecture.

expect will ultimately occupy the other lots owned by the Institute at this location, will be sufficient to house the Bartol research work and all of the chemical and physical laboratory work of the Committee on Science and the Arts and of all other departments of The Franklin Institute.

The equipment, except for certain standard apparatus that is immediately indicated as necessary, is to be installed gradually as the necessities of the research work in hand indicate. The contribution of the Bartol Research Fund to the cost of the laboratory building is measured by what we estimate it would cost the Committee on the Bartol Bequest to erect a building suitable for its work at a less expensive site. The building being owned by The Franklin Institute, the Bartol Research Bequest will be given a right to use the laboratory in its work for a period that may be definitely fixed or may be unlimited, according as we shall decide later.

The management of the work of the Bartol Research Committee will be in the hands of Dr. R. B. Owens, Director, reporting to the Committee, and with such research professors and fellows as it may be found necessary or important to engage. The sub-committee of Dr. Owens, Chairman; Dr. Joseph S. Ames, and Dr. Arthur L. Day, has been appointed to engage the necessary staff.

The Institute is to be congratulated upon this prospect of soon starting work on a building that will house a portion of its activities, and as we confidently anticipate, will be but the first step toward the construction of a group of buildings, now to be discussed herein.

Your Board thinks it wise at this time, and in this connection to advise you of its hopes and ambitions for the future housing and conduct of the work of the Institute.

The laboratory necessary to the proper housing of the Bartol research work, and of the chemical and physical work of the Committee on Science and the Arts, and of other departments of the Institute, has had reference herein. Our hope is that ultimately this laboratory will be one of a group of three buildings. We look forward to the date of the realization of our hopes and expectations, to see a building at the corner of Nineteenth Street and the Parkway, exteriorly worthy of a place among the noble structures then to be its neighbors and bearing a dignity worthy of the great name it will bear, and interiorly sufficient and suitable to the proper housing and conduct of all the Institute's work and equipment, except that the laboratory and museum are to be otherwise sheltered. The third building of the little group devoted to the promotion of the mechanic arts, when our hopes find fulfilment, will be so-called "Scientific and Technical Museum." In it will be properly arranged and connected for illustration and for operation, the many important models and facsimile apparatus now possessed by the Institute, and the multitude of such other things of interest to a follower of the mechanic arts as we have assurance will come to us when we are prepared properly to care for them. We believe that such a museum has no example in America. The American student, historian, mechanic or inventor, desiring to trace the development of an art through the study of concrete examples, must now journey to Europe to find what we will be able to present to him when our proposed museum is in operation.



on the next step of our program—the erection of the larger building—until we have a larger regular income dedicated to operating expenses. We think the Institute would not be justified in undertaking the full program now before us without an added endowment of a million dollars.

Thus the roughly estimated cost of completing our full program is two and a quarter million dollars. We believe that in the example of the founders of the Institute we may find the guide to the realization of our ambition. Efficient work in the public interest, the full utilization of what property has been confided to us, will in the future, as in the past, meet the approval of people seeking to dedicate some part of their accumulated wealth to the promotion of the mechanic arts. Always a part of our program is the efficient and economic application of our financial resources to such ends. We do not doubt that living to this part of our program in the future, as we have striven to live to it in the past, will bring such increase in financial resources as will make possible the full realization of the ambitions your Managers have herein discussed.

Respectfully submitted,

WALTON CLARK,

*President.*

PHILADELPHIA, January 18, 1922.

## REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

[ABSTRACT.]

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The Committee on Library respectfully submits the statement of activities in the library during the year ending September 30, 1921.

The additions to the library were as follows:

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	<hr/>
	468

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7116 copies of the Journal were used for exchange purposes.

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The total number of exchanges on September 30th was 586. The subscriptions totaled 130 and the number of gift subscriptions was 73, making the total periodical publications currently received, 789.

*Evening Hours:*

The library was open on meeting nights until ten o'clock, in all, thirty-five evenings.

Respectfully submitted,

H. JERMAIN CREIGHTON,  
*Chairman.*

PHILADELPHIA, January 11, 1922.

## REPORT OF THE COMMITTEE ON MUSEUM

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multiplex operation were considered and a brief historical resume of the invention and early development of this new means of communication given. Current practical engineering methods were discussed, including special applications to hydro-electric power line operation and train dispatching. The subject of attenuation and required power were also treated. Lantern slides were used to illustrate the subject and a working demonstration was given of communication by means of guided wave telephony superimposed upon a physical telephone circuit. Published in the *JOURNAL*, March, 1921.

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"Electron tubes or simply vacuum tubes, as they are most often called, are coming into very general use for quite a wide variety of purposes. Their flexible characteristics and variety of properties also make them very useful in laboratories and for engineering tests and developments. However, in the use of these tubes for special purposes, difficulties are frequently encountered which are due to properties of the tube which are not commonly known or understood." The lecture described a number of these more unusual characteristics, the effects of which, however, are often commonly met with in practice and give experimental difficulty or prevent the correct interpretation of results. The subject was illustrated by lantern slides. The paper was published in the *JOURNAL* for April, 1921.

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types of vessel in the future will be determined largely by these changes, and a second analysis will estimate the effects of the changes. There will probably be always a place for both types of ship, the problem being to define the position in which each is best, by analysis of characteristics, and to estimate the comparative numbers of each required for handling world trade." The subject was illustrated by lantern slides. This paper appeared in the July and August, 1921 numbers of the JOURNAL.

At this meeting Mr. Henry R. Towne of New York presented to the Institute an odometer made by Isaiah Lukens, one of the two first elected Vice-presidents of the Institute and first Chairman of the Institute's Committee on Inventions. An account of this instrument appears in the JOURNAL for August, 1921.

May 18, 1921: 3:30 o'clock P. M. Certificate of Honorary Membership was presented to General John J. Pershing, General of the Armies of the United States.

The Franklin Medal, accompanying certificate, and Certificate of Honorary Membership were presented to His Excellency M. Jusserand, French Ambassador, for Professor Charles Fabry of the University of Paris, Paris, France.

The Franklin Medal, accompanying certificate, and Certificate of Honorary Membership were presented to Dr. Frank J. Sprague of New York City.

Dr. Joseph S. Ames of The Johns Hopkins University, Baltimore, Maryland read Professor Charles Fabry's paper on "Studies in the Field of Light Radiation."

Dr. Frank J. Sprague read his paper "Electric Traction: A Review."

A detailed account of the meeting appears in the JOURNAL for September, 1921 as well as the papers by Dr. Fabry and Dr. Sprague.

The attendance at these meetings totaled 1244.

Manuscripts of most of the papers have been received and those not yet published will appear in early issues of the JOURNAL.

Respectfully submitted,

GELLERT ALLEMAN,  
*Chairman.*

PHILADELPHIA, January 11, 1922.

## REPORT OF THE COMMITTEE ON INSTRUCTION FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

*To the Board of Managers of The Franklin Institute:*

The courses offered in the ninety-seventh year of The Franklin Institute School of Mechanic Arts, commencing in September, 1920, were substantially the same as those given the preceding year. Classes were formed in Mechanical Drawing, Architectural Drawing and Design, Freehand Drawing and Water Color, Shop Arithmetic and Algebra, Plane Geometry and Trigonometry, Applied Mechanics and Strength of Materials, Machine Design, Structural Design, and Theoretical and Practical Naval Architecture.



During the year, students and alumni of the school visited the following places of engineering interest:

Point Breeze Gas Works of the United Gas Improvement Company, Philadelphia, Pa.

Delaware County Power Station of The Philadelphia Electric Company, Chester, Pa.

The Atlantic Refining Company, Philadelphia, Pa.

Bridesburg Plant of The Ajax Metal Company, Philadelphia, Pa.

American Engineering Company, Philadelphia, Pa.

Bement-Miles Works, Philadelphia, Pa.

Hess-Bright Manufacturing Company, Philadelphia, Pa.

Leeds & Northrup Company, Philadelphia, Pa.

Link Belt Company, Philadelphia, Pa.

Newton Machine Tool Works, Philadelphia, Pa.

Warren Webster & Company, Camden, N. J.

Beach Street Power Station of The Philadelphia Rapid Transit Company, Philadelphia, Pa.

The New York Shipbuilding Company, Camden, N. J.

In every case the attendance was good and much interest was shown by those present.

The graduating exercises were held in the Hall of the Institute on the evening of April 15, 1921. In the absence of Dr. Walton Clark, President of the Institute, Mr. Coleman Sellers, Jr., Vice-President, presided. The speaker of the evening was the Honorable Edwin S. Stuart, Ex-Governor of Pennsylvania. The Alumni Association was represented by Mr. James G. Morgan. Sixty-nine students, the largest number in any one year of the history of the school, were graduated: four in Mechanical Drawing, eight in Architectural Drawing, one in Freehand Drawing and Water Color, thirty-nine in Mathematics, eleven in Mechanics, and six in Naval Architecture.

The following scholarships were awarded:

Six B. H. Bartol Scholarships,

Six Isaac B. Thorn Scholarships.

The prize provided by the late John H. Siegler, Esq., Germantown, Philadelphia, Pa., in his will dated February 21st, 1918, was awarded jointly to a student in Naval Architecture and a student in Mathematics.

Following is an abstract of the will containing the conditions of the award:

"I give and bequeath unto The Franklin Institute the sum of one thousand dollars (\$1000), to be invested and kept invested, and the income arising therefrom and thereout to be given annually as a prize to the student deserving the highest commendation for earnest work and high standard of scholarship in regular attendance upon the sessions during the school year last past."

The student of greatest merit in the Department of Mathematics was awarded a prize donated by Mr. J. B. McCall, President of the Philadelphia Electric



ELECTIONS :

	1918-19	1919-20	1920-21
Resident Members .....	21	32	30
Non-Resident Members .....	28	19	35
Associate Members .....	4	11	5
Honorary Members .....	10	2	3
Corresponding Members .....	0	3	0
Life Members .....	3	0	2
Second Class Stock .....	0	0	0
	—	—	—
	66	67	75

RESIGNATIONS :

Resident Members .....	17	19	9
Non-Resident Members .....	10	14	14
Associate Members .....	0	0	1
Second Class Stock .....	0	0	0
	—	—	—
	27	33	24

DEATHS :

Resident Members .....	8	6	8
Non-Resident Members .....	12	8	6
Life Members .....	11	8	14
Honorary Members .....	1	1	0
Associate Members .....	2	0	0
Second Class Stock .....	1	0	1
	—	—	—
	35	23	29

SUMMARY :

Elections .....	66	67	75
Resignations .....	27	33	24
Dropped for non-payment of dues ....	10	27	16
Deaths .....	35	23	29
Net increase in membership .....		6	

Membership of the Institute by Classes, September 30th, 1921.

Resident Members .....	516
Non-Resident Members .....	584
Life Members .....	204
Honorary Members .....	24
Associate Members .....	31
Second Class Stock Members .....	24
Corresponding Members .....	3
	—
Total .....	1,386

It will be noted that while the year ending September 30th, 1920 showed a decrease in membership of 16, the current year has been more favorable, a net increase in membership of 6 being shown.

Respectfully submitted,

R. W. LESLEY,  
*Chairman.*

PHILADELPHIA, January 11, 1922.

## REPORT OF THE COMMITTEE ON STOCKS AND FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

*To the Board of Managers of The Franklin Institute:*

The Committee presents the following financial statement:

### PROPERTY AND FUNDS.

Building and land, 13-17 South Seventh Street.....	\$60,000.00		
Library .....	100,000.00		\$160,000.00
	Principal	Unexpended Income	
Funds held by Board of Trustees.....	\$626,953.66	\$2,240.09	
Funds held by Board of Managers.....	151.72		
Franklin Institute Building Fund .....	522,984.65		
Elliott Cresson Medal Fund.....	3,000.00	715.51	
Franklin Fund and Building Committee..	14,971.17		
	<hr/>	<hr/>	
Total Funds .....	\$1,168,061.20	\$2,955.60	\$1,171,016.80
			<hr/>
Grand Total .....			\$1,331,016.80

### LIABILITIES.

Certificates of Stock .....	\$29,240.00
Bills Payable .....	11,000.00
Vouchers Payable .....	4,975.25
Unearned Income .....	3,958.10
	<hr/>
	\$49,173.35

INCOME AND EXPENSES APPLICABLE TO YEAR ENDED SEPTEMBER 30, 1921.

### *Income:*

Dues: Resident .....	\$7,320.00	
Non-resident .....	2,962.50	
Second Class Stock .....	288.00	
Associate .....	145.00	\$10,715.50
	<hr/>	

Initiation Fees .....		160.00
Harriet Blanchard Legacy .....		55,551.78
H. Belfield Memorial Fund .....		268.82
James H. Cresson Memorial Fund .....		2,267.92
General Endowment Fund .....		19,149.88
John H. Wahl Fund .....		4,583.05
James T. Morris Memorial Fund .....		350.00
Lewis S. Ware Library Fund .....		650.00
Estate of John Turner .....		156.34
Estate of Robert Wright .....		1,935.24
Instruction: Drawing .....	\$2,680.00	
Mathematics .....	2,602.00	
Mechanics .....	957.50	
Naval Architecture .....	1,090.00	7,329.50
<hr/>		
Publications: Subscriptions and Sales .....	\$4,040.96	
Advertising .....	4,811.20	8,852.16
<hr/>		
		\$111,970.19

EXPENSES.

Building: Wages .....	\$1,802.07	
Repairs and Maintenance .....	709.48	
Taxes, Water Rent and Insurance .....	477.67	
Heat, Light and Power .....	1,298.42	
Miscellaneous Supplies and Expense .....	343.43	\$4,631.07
<hr/>		
Instruction: Drawing .....	\$1,526.50	
Mathematics .....	1,287.50	
Mechanics .....	785.00	
Naval Architecture .....	1,008.00	
Salaries and Annuities .....	1,696.28	
Miscellaneous Expenses .....	831.80	7,135.08
<hr/>		
Library: Salaries .....	\$7,558.40	
Books and Periodicals .....	1,368.69	
Binding .....	1,131.06	
Miscellaneous Expense .....	229.36	10,287.51
<hr/>		
Meetings .....		1,301.58
Office and General: Salaries .....	\$13,143.31	
Office Expense .....	1,364.59	
General Expense .....	1,298.47	
Auditor and Treasurer .....	849.81	16,656.18
<hr/>		



Publications: Printing .....	\$15,450.95	
Reprints .....	1,033.54	
Illustrating .....	3,324.22	
Miscellaneous Expense .....	582.53	
Year Book .....	854.31	21,245.55
		<hr/>
Science and Arts .....		3,763.95
Sections .....		2,227.42
Interest and Discount .....		1,196.59
Badges and Certificates .....		58.10
Elections and Resignations .....		2.76
Miscellaneous Income and Expense .....		63.19
		<hr/>
Total .....		\$68,568.98
		<hr/>
Surplus .....		\$43,401.21

The operating surplus as shown was due to the receipt of extraordinary income in the shape of the Harriet Blanchard Legacy of \$55,551.78. The surplus was applied to the reduction of liabilities. There was also an addition of \$21,370.50 during the year in the principal of funds held by the Institute.

Respectfully submitted,

WALTON FORSTALL,  
*Chairman.*

PHILADELPHIA, January 11, 1922.

## REPORT OF THE COMMITTEE ON PUBLICATIONS

### FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

*To the Board of Managers of The Franklin Institute:*

The two principal publications of the Institute, its monthly JOURNAL and the Year Book, have been published as usual. A sufficient number of copies of the JOURNAL were issued to supply a copy to each member of the Institute, to provide copies for sales by home and foreign book dealers, to make exchanges with similar publications of other Institutions and with scientific and technical Journals and to place copies on file in Scientific Libraries.

To meet this demand 2625 copies have been printed each month throughout the year.

The Year Book is also supplied to the membership of the Institute and distributed to the leading Scientific Societies throughout the world, this requiring the publication of 2000 copies.

In addition to the information usually contained, the Year Book for 1921 includes a complete list of all awards granted by the Institute on the recommendation of the Committee on Science and the Arts since the various awards were established.

Many of the lectures delivered in The Franklin Institute course of lectures were printed in the JOURNAL, as well as special articles contributed by leading scientists and technologists with the purpose of making the JOURNAL a record of original research and a report of progress in scientific fields.

An edition of 2000 copies of "Physics of the Air," by Dr. W. J. Humphreys, Professor of Meteorological Physics, U. S. Weather Bureau, was published during the year, and of these, 960 copies were sold. This book contains the most complete treatment of the subject yet published and is recognized as an authority.

The notes from the various Scientific Bureaus and Research Laboratories were continued throughout the year and contained the most recent accounts of the activities of these various Institutions.

The material published under the heading of Current Topics was prepared by several members of the Institute.

While there has been a slight decrease in the price of paper suitable for the printing of the JOURNAL, the cost of publication is still very high. The expenses for the year are as follows:

Printing .....	\$15,450.95
Reprints .....	1,033.54
Illustrations .....	3,324.22
Year Book .....	854.31
Miscellaneous Expense .....	582.53
<hr/>	
Total .....	\$21,245.55

Acknowledgement is due to our Associate Editors for valuable coöperation rendered during the year.

*Respectfully submitted,*

GEORGE D. ROSENGARTEN,  
*Chairman.*

PHILADELPHIA, January 11, 1922.

**REPORT OF THE COMMITTEE ON EXHIBITIONS**  
**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.**

*To the Board of Managers of The Franklin Institute:*

The subject which would properly come within the scope of the activities of the Committee on Exhibitions during the past year, is the Sesqui-Centennial Exhibition. There has been so little progress made with this project that the Chairman of this Committee has not deemed it advisable to call a meeting of the Committee, especially when he found, after a consultation with various members of the Mayor's General Committee and the heads of a number of influential organizations, that a general feeling prevailed that no substantial progress could be made until there was a change in the personnel of the committees having the movement in charge.



December 9, 1920.

Dr. John S. Shearer, of the Department of Physics, Cornell University, presented a paper on "Recent Advances in the Production and Application of X-rays." The newer apparatus and the technic for the production of X-rays were described. An account was given of Laue's work on diffraction by crystals, the X-ray Spectrum, and absorption of X-rays for separate wavelengths. The relation of X-rays to the physical theory, to therapy, and to the industries was traced. The subject was illustrated by lantern slides.

January 6, 1921.

The paper of the evening on "Smoke and Incendiary Materiel" was presented by Dr. L. I. Shaw, Assistant Chief Chemist of the Bureau of Mines.

A discussion of the development and uses of portable and non-portable flame projectors, smoke producers, smoke and incendiary bombs, and other smoke and incendiary materiel was given. Consideration was also given to the need and method of employment of such materiel as well as the best type of each class developed or used by the United States, allied or enemy nations. The subject was illustrated by lantern slides and specimens of flame projectors, smoke producers, smoke and incendiary bombs.

January 27, 1921.

The paper of the evening, entitled "America's Petroleum Problem," was presented by Mr. James O. Lewis, Chief Petroleum Technologist, Bureau of Mines, Washington, District of Columbia.

An outline was given of the American petroleum industry. The sources of domestic supply and the total crude oil supply of the world were discussed. The lecture concluded with an account of the various ways in which the domestic supply may be so increased as to meet the growing demand. Lantern slides were used to illustrate the lectures. Published in the *JOURNAL* of the Institute, March, 1921, issue.

March 10, 1921.

The paper of the evening on "Chemical Factors in Nutrition" was presented by Lafayette B. Mendel, Ph.D., Sc.D., Professor of Physiological Chemistry, Yale University, New Haven, Connecticut.

The speaker reviewed the history of the changing conceptions regarding the rôle of digestion in nutrition, and indicated how the newer investigations have contributed to the formulation of present-day views regarding what constitutes a food. Reference was also made to some of the current ideas of metabolism, its relation to the chemical composition of the diet, its variations in health and disease and the limitations of our knowledge thereto. The subject was illustrated by lantern slides. Published in the July, 1921, issue of the *JOURNAL*.



# YEAR BOOK OF

February 3, 1921.

Dr. Louis Cohen, Consulting Engineer, Washington, District of Columbia, and Major J. O. Mauborgne, of the Office of the Chief Signal Officer, Washington, District of Columbia, presented a communication entitled "A New Method for the Reception of Radio Signals, Eliminating Static Interference."

The general problem of radio-receiving circuits from the standpoint of selectivity was considered and a resumé was presented of previous efforts in the design of radio-receiving circuits to secure freedom from interference. A description was given of a new type of circuits for receiving radio signals, recently developed by the speakers, making use of resonance wave coils, which effects a great reduction in interferences either that of nearby stations or of static disturbances. The subject was illustrated by lantern slides.

February 24, 1921.

The paper of the evening on "The Economic Aspects of Railway Electrification" was presented by Mr. A. H. Armstrong, M.E., Chairman, Electrification Committee, General Electric Company, Schenectady, New York.

After a review of the present condition of the railway service, due largely to the soaring price of fuel and labor, consideration was given to the economic advantages which will result from the universal replacement of the steam engine. An account was given of the development of the electric locomotive and its use on the several railway lines throughout the United States. Attention was also called to its great reliability and low cost of maintenance. The subject was illustrated by lantern slides. Published in the April, 1921, issue of the JOURNAL.

March 24, 1921.

Mr. W. E. Ruder, B.S., of the Research Laboratory, General Electric Company, Schenectady, New York, read the paper of the evening on "The Science of Electric Welding."

A brief historical review of the subject was given and the methods and apparatus used at present in practice were described. The nature of the metal deposit was also discussed and the recent work done along the line of perfecting it. The commercial aspect of electric welding was considered from the point of view of the manufacturer and the electricity supply company. The subject was illustrated by lantern slides.

Mining and Metallurgical Section: One meeting.

April 7, 1921.

George Otis Smith, Ph.D., Sc.D., LL.D., Director, U. S. Geological Survey, Department of the Interior, Washington, District of Columbia, presented the paper of the evening entitled "Geology in Partnership with American Industry" in which the growth of the professions of industrial and engineering geologists was described as well as their part in the development of the coal industries.

Section of Photography and Microscopy: One meeting.

December 2, 1920.

The paper of the evening was presented by C. E. K. Mees, D.Sc., Director, The Research Laboratories of the Eastman Kodak Company, Rochester, New York, entitled "The Structure of Photographic Images."

The relationship between the size, number, and arrangement of the particles of silver halide in the photographic emulsion and the graininess of the image was discussed. Other factors which modify the image were also considered. The subject was illustrated by lantern slides. Published in the *JOURNAL*, May, 1921, issue.

Mechanical and Engineering Section: Five meetings.

January 13, 1921.

Mr. William Gatewood, of the Newport News Shipbuilding Company, Newport News, Virginia, presented a communication entitled "The Modern Cargo Vessel."

An outline was given of the history and development of cargo vessels and their importance in world economics. The present types were discussed as well as the effect of their material, size, speed, construction, and equipment on their usefulness. Some of the problems involved in their building and operation were discussed and the importance of proper governmental action if the home port of the vessel carrying our cargo is to be in this country instead of abroad, as it was before the war. The subject was illustrated by lantern slides. This paper appeared in the March, 1921, *JOURNAL*.

February 10, 1921.

Mr. Frank S. Clark, Mechanical Engineer with Stone and Webster, Inc., Boston, Massachusetts, presented the paper of the evening entitled "Modern Steam Power Station Design."

A brief outline was given of the development of the art of power station design corresponding with the progress in the design and construction of station equipment, and the points to be observed in order to secure reliability of service by proper selection, arrangement, and installation of equipment were discussed. Consideration was also given to the various factors affecting the choice of design and sizes of units, such as character of service, peak load, load factor (annual and daily), growth of load, probable ultimate capacity and local topographical and other conditions peculiar to the available sites. The economy of station operation and its attainment by the working out of the proper heat balance, the selection of the operating steam pressure and temperature, the fuel to be used and the simplicity and compactness of the arrangement were discussed in detail. The paper was illustrated by lantern slides.

March 3, 1921.

Mr. C. A. Emerson, Jr., B.S. C.E., Chief, Engineering Division, Department of Health, Commonwealth of Pennsylvania, Harrisburg, Pennsylvania, read a communication entitled, "The Disposal of Industrial Wastes and Stream Pollution."

Consideration was given to the engineering aspect of recent developments in methods of treatment of some of the industrial wastes widely distributed throughout Pennsylvania. The possibilities of the prevention of stream pollution and the recovery of by-products were pointed out. The subject was illustrated by lantern slides. The paper appeared in the June, 1921, JOURNAL.

March 31, 1921.

The paper of the evening entitled "Some Applications of Physics to Ordnance Problems," was presented by Gordon F. Hull, Ph.D., Technical Staff, Office of the Chief of Ordnance, War Department, Washington, District of Columbia.

Experiments to determine the law of air resistance were described as well as the results obtained by holding a projectile in an air stream and measuring the force upon it. Photographs were shown of the disturbed air about a projectile and the underlying physical principles involved. New apparatus and new methods for determining the retardation of a projectile were described and an account was given of experiments to determine the stability of a shell. The subject of pressures in guns was also given consideration. The paper was illustrated by lantern slides. Published in the September, 1921, issue of the JOURNAL.

April 14, 1921.

The following papers were presented:

"The Characteristics of the Electric Locomotive," by Mr. N. W. Storer, General Engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

The speed and tractive effort characteristics of the different types of electric locomotives were discussed, and a comparison of the similar characteristics of steam locomotives was presented. Questions relating to speed control, regenerative braking and the advantages and limitations of the electric locomotive with respect to short time, heavy loading, mileage, etc., were also discussed.

Mr. A. W. Gibbs, Chief Mechanical Engineer, Pennsylvania System, Philadelphia, and a member of the Institute's Board of Managers, presented a communication entitled "Some Mechanical Characteristics of High-Speed, High-Power Locomotives."

In this paper were discussed such questions as the mechanical applications of the electric power and the stability of both steam and electric locomotives as vehicles as determined in road tests on recording track.

Both communications were illustrated with lantern slides.

Both papers appeared in the October, 1921, issue of the JOURNAL.





Application was made to the Treasury Department for return of the inheritance tax paid in error and the application was refused. Hearing was requested and after long correspondence and repeated visits to Washington, our claim for a refund was allowed to the extent of \$3,358.32 in the H. W. Bartol estate and \$1,538.31 in the B. H. Bartol estate. In addition, a claim for a credit of \$7,838.06 has been allowed.

As the charter of The Franklin Institute as modified by the act of April 25, 1864, limits the real estate held by the Institute to a clear yearly value of not exceeding \$10,000 it became necessary to have this limit increased. Application was, therefore, made to the court to increase the amount of property which may be legally held by The Franklin Institute under the act of June 1, 1915. A decree was signed by the court March 18, 1921, authorizing The Franklin Institute to acquire and hold real and personal estate of the yearly value of \$150,000.

On March 24th, we were informed by the Executor that The Franklin Institute is one of the residuary legatees of the estate of George Theodore Roberts, who died March 11, 1921, and who left his estate for life to an unmarried daughter, on whose death the estate is to be divided among fourteen institutions share and share alike. We have been advised that our interest in this estate would probably be not less than \$40,000.

Respectfully submitted,

COLEMAN SELLERS, JR.,

*Chairman.*

PHILADELPHIA, January 11, 1922.

## REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

*To the President and Members of The Franklin Institute:*

The year just closed was the eighty-seventh in which the Committee on Science and the Arts has rendered service to the Institute. During this year the Committee has investigated and made final disposition of twenty cases and sixteen are now pending.

A reading of the appendix to this report will show the scope of the activities of the Committee in its investigations, the subjects including many fields of scientific investigation and industrial application.

The minutes of the Committee have furnished data from which there has been published in the Year Book for 1921, a list of all awards made on its recommendation since the establishment of the several awards. These lists total 892 awards, divided as follows:



prepared by Professor Fabry for the occasion, and Dr. Sprague presented a paper on "Electric Traction—A Review."

The attendance at the Stated Meetings of the Committee on Science and the Arts has been most satisfactory. The dinners preceding the meetings have been well attended and serve to make those who attend better acquainted as well as to give an opportunity for the discussion of questions pertaining to the work of the Committee.

A detailed statement of the work of the Committee during the past year is appended.

Respectfully submitted,  
C. W. MASLAND, *Chairman.*

APPENDIX.  
STATEMENT OF THE COMMITTEE'S OPERATION  
FOR THE  
YEAR ENDING SEPTEMBER 30, 1921.

Cases pending October 1, 1920 .....	17
Applications during the year .....	11
Special reports .....	2
	<hr/>
	30
Disposed of during the year .....	20
Leaving pending .....	10

AWARDS MADE.

Franklin Medal Awards .....	2
Elliott Cresson Awards. ....	2
Howard N. Potts Awards. ....	3
Edward Longstreth Awards. ....	8
Certificates of Merit Awards. ....	4
	<hr/>
	19

AWARDS MADE DURING THE YEAR.

THE FRANKLIN MEDAL.

Professor Charles Fabry, of Paris, France, "in recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

Mr. Frank Julian Sprague, of New York, N. Y., in recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

THE ELLIOTT CRESSON MEDAL.

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.



# THE FRANKLIN INSTITUTE AWARDS

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OCTOBER, 1921, TO JUNE, 1922.

## THE FRANKLIN MEDAL.

TO

Dr. Ralph Modjeski, of New York "in recognition of his signal achievements as a designer and builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer vision, courage and technique of the highest order."

Sir Joseph John Thomson, of Cambridge, England, "in recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

## THE HOWARD N. POTTS MEDAL.

TO

E. G. Coker, of London England, for his Method of Determining Stress by Photo-Elastic Means.

Richard B. Moore, of Washington, D. C., for his paper entitled "Helium, Its History, Properties and Commercial Development."

Messrs. John Morris Weiss and Charles Raymond Downs, of New York, for their joint invention of the Vapor Phase Oxidation of Benzene to Maleic Acid.

## THE EDWARD LONGSTRETH MEDAL.

TO

Samuel T. Freas, of Trenton, New Jersey, for his inventions and improvements embodied in the "Interlocking" Tooth Saw.

James Hartness, of Springfield, Vermont, for his Screw Thread Comparator.

Thomas Willing Hicks, of Minneapolis, Minnesota, for his "Once-Over" Tiller.

Joseph F. Keller, of Brooklyn, New York, for his inventions and improvements embodied in the Automatic Die Cutting Machine.

Martin F. Tiernan, of Newark, New Jersey, jointly with Charles F. Wallace, for his inventions embodied in the Chlorinator.

Charles F. Wallace, of Newark, New Jersey, jointly with Martin F. Tiernan, for his inventions embodied in the Chlorinator.

THE CERTIFICATE OF MERIT.

TO

Rear Admiral W. H. G. Bullard, of Washington D. C., for his paper entitled  
“The Application of Radio to Navigation Problems.”

Harry Etchells, of Sheffield, England, jointly with H. A. Greaves for his  
inventions and improvements embodied in the Electric Arc Furnace.

H. A. Greaves, of Sheffield, England, jointly with Harry Etchells, for his  
inventions and improvements embodied in the Electric Arc Furnace.

Charles E. Mendenhall, of Madison, Wisconsin, for his paper entitled  
“Aeronautic Instruments.”

Arthur H. Pitney, of Stamford, Connecticut, for his Postage Meter.

Walter Kidde and Company, of New York, for their improvements made  
on the Rich System of Detecting and Extinguishing Marine Fires.

# **AWARDS**

**1835-1922.**

## **FRANKLIN MEDAL AWARDS.**

**1915-1921.**

**ARRHENIUS, SVANTE AUGUST.**

“In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry.”

1920.

**CARTY, JOHN J.**

“In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances.”

1916.

**DEWAR, SIR JAMES.**

“In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena, and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude.”

1919.

**EDISON, THOMAS ALVA.**

“In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race.”

1915.

**FABRY, CHARLES.**

“In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance.

1921.





SQUIER, GEORGE OWEN.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.

THOMSON, SIR JOSEPH JOHN.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

## CRESSON MEDAL AWARDS

1856-1921.

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, DR. LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixtures of Metals.—1904

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-Wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H., AND ALFRED, H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PROF. AND MADAME.

Researches Resulting in the Discovery of Radium.—1909

DELANDTSHEER, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUTT.

Electric Motor and Battery.—1881.

HADFIELD, ROBERT A.

Advancement of Metallurgical Science.—1910.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HAUPT, L. M.

Reaction Breakwater.—1901.

- HAYES, MAYER AND COMPANY.  
Manufacture of Files.—1890.
- HEANY, J. ALLEN.  
Fireproof Insulated Wire.—1907.
- HERSCHEL, CLEMENS.  
Venturi Meter.—1898.
- HOLLERITH, H.  
Electric Tabulating Device.—1890.
- HOLMES, P. H.  
Lubricant Bearing.—1892.
- HOUGH, R. B.  
Contributions to the Characteristics and Uses of the American Woods.—1908.
- HOWE, H. M.  
Experimental Research on Steel.—1895.
- HOWE, H. M.  
Metallurgy of Steel.—1892.
- IVES, FREDERICK E.  
Color Photography.—1893.
- JENKINS, C. FRANCIS.  
"Phantoscope."—1898.
- LANSTON, T.  
Monotype Machine.—1896.
- LEVY, L. E.  
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
- LEVY, L. E.  
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.  
Machine Gun.—1918.
- LINDE, KARL P. G.  
Refrigeration Processes.—1914.
- LOWE, THADDEOUS S. C.  
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.  
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.
- LUMIÈRE, AUGUSTE AND LOUIS.  
Color Photography.—1909.
- MALLET, A.  
Articulated Compound Locomotive.—1908.
- MARKS, G. E.  
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.  
Liszt Organ.—1901.
- MERGENTHALER, O.  
Linotype.—1889.

ANDERSON, A. A.

Work in Physical Optics.—1912.

ARNOUX, HENRI.

Investigations with the Electric Furnace.—1898.

BARRETT, E. W.

Determination of Fundamental Magnitudes in Chemistry.—1912.

BORER, ALFRED.

Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E. JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, F. D. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

SAUVEUR, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

SPELLIER, LOUIS H.

Time Telegraph.—1881.

SPRAGUE, F. J.

Multiple Unit System of Electric Traction.—1903.

SQUIER, MAJOR GEO. OWEN.

Multiplex Telephony.—1912.

STEINMETZ, C. P.

Application of Analytics to Electrical Engineering.—1913.

STRATTON, S. W.

Leading Work in Metrology.—1912.

TALBOT, B.

Open Hearth Steel Process.—1909.

TATHAM, W. P.

Printing Press.—1875.

TAYLOR, E. R.

Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.

TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.

Process of Treating Tool Steel.—1902.

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-Elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., and BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.



LONGSTRETH MEDAL AWARDS

1890-1921.

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BRADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

- BRISTOL, W. H.  
Recording Pressure Gauge.—1894.
- BROWN, HAROLD P., AND EDISON, THOMAS A.  
Rail Bonds and Electrical Contacts.—1899.
- CAFFREY, C. S., AND COMPANY.  
Improvement in Carriages and Wagons.—1900.
- CARTY, J. J.  
Bridging Bell System.—1905.
- CHAFFEE, E. L.  
“Continuous Electric Oscillations” (Paper).—1913.
- CHANCE, E. M.  
“Pathogenic Mine Atmospheres” (Paper).—1912.
- CHENEY, W. L.  
Lathe Tool and Support.—1895.
- CHENOWETH, A. C.  
Method of Constructing Sewers.—1892.
- CLARK, WM. H., AND COLLINS, FRANK W.  
Cortlandt, Howe Ventilating Stove.—1894.
- COLLINS, FRANK W., AND CLARK, WM. H.  
Ventilating Stove.—1894.
- COLT’S PATENT FIRE ARMS MANUFACTURING COMPANY.  
Automatic Pistols.—1906.
- COOPER, W. S.  
Specimens of Aluminum Castings.—1895.
- COX, JACOB D., AND ARMSTRONG, WM. T.  
Grip Socket.—1896.
- CREIGHTON, H. JERMAIN.  
“The Deteriorating Action of Salt and Brine on Reinforced Concrete”  
(Paper).—1918.
- CRISFIELD, J. A. P.  
Moisture Determinator for Coke and the Like.—1909.
- CUMMINGS, H. H.  
Speed Controllers.—1903.
- CUSHMAN, ALLERTON S.  
“Researches on the Corrosion of Iron and Steel” (Paper).—1908.
- DANA, A. S., KENNELLY, A. E., ACHARD, F. H.  
“Experimental Researches on the Skin Effect in Steel Rails” (Paper).  
—1917.
- DESHLER, CHARLES, and McALLISTER, EDWARD J.  
Portable Photometer.—1900.
- DEVÖE, W. R.  
Conduit Electric Railway.—1894.
- DODGE, WALLACE H.  
Wooden Split Pulley.—1891.

HERR, H. T.

“Development of Steam Turbines” (Paper).—1914.

HICKS, THOMAS WILLING.

“Once-Over” Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J., AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER CO.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

“Volcanic Dust, Climatic Changes and Ice Ages” (Paper).—1914.

HYDE, E. P.

“Physical Production of Light” (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, H. E., KINGSBURY, E. F., KARRER, E.

“The Physics of the Welsbach Mantle” (Paper).—1919.

IVES, H. E.

“Artificial Daylight” (Paper).—1915.

IVES, H. E.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, F. E.

Photo-Micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

“Nature of Solution” (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).  
—1917.

KINGSBURY, E. F.; KARRER, E.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper). 1912.

LEDOUX, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper). 1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MILEY, HENRY M., AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NORTHROP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-Violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

## YEAR BOOK OF

Low Pressure Friction Clutch.—1897.

W. H. SCHOENFUR, F. H.

Water Meter. 1917.

Window. 1892.

1900.

COMPANY.

1904.

1902.

"Combustible Cases" (Paper).—1914.

Trailing Trucks for Locomotives.—1910.

Automatic Water Heater.—1904.

W. H. SCHOENFUR

1901.

1901.

Platform Weighing Scale.—1919.

JOSEPH.

1904.

RUSSELL.

1901.

ALBERT.

1917.

1900.

"Soils" (Paper).—1912.

1901.

1903.

1900.

Screening Machines.—1904.

COMPANY.

1916.

1901.

1914.

1900.

—1903.

H. HOCHKLAHN, H.

1901.

- SIEBER, JOSEPH, AND SCHMIDT, MAX E.  
Movable Side-Walk.—1894.
- SKINNER, JOSHUA J.  
“Soil Aldehydes” (Paper).—1919.
- SNOOK, HOMER CLYDE.  
X-Ray System.—1919.
- SPITZGLASS, JACOB M.  
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.  
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.  
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.  
“Propagation of Electric Waves Along Wires” (Paper).—1913.
- STRADLING, GEORGE F.  
“Modern Theories of Magnetism” (Paper).—1916.
- STUMPF, J.  
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.  
Radojet Air Pump.—1920.
- TAINTOR, C. C.  
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.  
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.  
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.  
“Measurement of Gases” (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.  
Chlorinator.—1922.
- TOERRING, C. J.  
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.  
Improved Thermometer Support.—1907.
- TUCKER, W. H.  
Letter and Document Files.—1900.
- TURNER, W. V.  
“Locomotive Air-Brake” (Paper).—1911.
- TUTWILER, C. C.  
“Recovery of Gas Works by-Products” (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.  
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.  
Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.



## CERTIFICATE OF MERIT AWARDS

1885-1921.

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

“A New Theory of Plate Springs” (Paper).—1920.

McCHESNEY, R.

Improved in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

McINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MENDENHALL, CHARLES E.

“Aeronautic Instruments” (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

PARR, PERCY H., AND LANDAU, DAVID.

“A New Theory of Plate Springs” (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.

Magnetic Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.

Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

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Tobacco Machine.—1901.
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- ALGER, H. C.  
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- ALMOND, T. R.  
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- ALMOND, T R.  
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Light Projecting Glass.—1901.
- ANDERSON, H. N.  
Gear Rolling Machine.—1915.
- ANDERSON, LEVI.  
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Votometer.—1901.

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Compasses.—1835.

**BATCHILLOR, B. C.**

Pneumatic Dispatch Tube Apparatus.—1899.

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Coin Counting and Wrapping Machine.—1914.

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Improved Corliss Engine.—1895.

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Index for Ascertaining Latitude.—1837

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Hollow Handled Cutlery.—1883.

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High Speed Electric Generators.—1909.

**BEHREND, G. L. H., AND BREMAR, A.**

Aspirator for Mill Stones.—1877.

**BELL, CHEICHESTER A., AND TAINTER, SUMMER.**

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Germ Proof Water Filter.—1893.

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International Money Machine.—1917.

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Typewriting Machine. 1901.

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Electrical Signal Clock. 1883.

**BLONDEL, ANDRE, AND PAAROWDARI, SPIRIDION.**

Holophone Globes.—1898.

BRADLEY, ANDREW.

Stencil Machine.—1902.

BRAMWELL, W. C.

Feeding Machine for Fibrous Material.—1894.

BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.

Refrigeration Process.—1894.

BREHMER, HUGO, AND HEYL, HENRY RAND.

Wire Book Sewing Machine.—1883.

BREMAR, A., AND BEHRNS, G. L. H.

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BROWN, EDWARD.

Pyrometers.—1897.

BROWNING, JOHN M.

Automatic Pistol.—1906.

BURGER, H. J.

Photo-Polychrome Printing Apparatus.—1903.

BURRELL, JOHN H., AND METZLER, C. E.

Railway Signal Lantern.—1885.

BURROUGHS, W. S.

Calculating Machine.—1897.

BURROWS, AMOS E.

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CARLETON, CYRUS, AND WILCOX, CHARLES H.

Automatic Tension and Improved Sewing Machines.—1875.

CARNELL, CHARLES.

Brick Machine.—1850.

CARNEY, THOS.; COOK, H.; AND PATTERSON, H. G. AND J. H.

Cash Registers.—1901.

- RICHARDS, G. M.  
Automatic Fluid Pressure Friction Clutch.—1897.
- RIKER, C. L.  
Lavatory.—1900.
- RINGLAND, ALBERT, AND SCHOENFUSS, F. H.  
Portable Brinell Meter.—1917.
- ROBY, HENRY W.  
Screw Jack.—1891.
- ROEDER, J. R.  
Improvement in Windows.—1892.
- ROPER, CHARLES.  
Safety Propellers—1909.
- ROSENDALE BELTING COMPANY.  
Camel Hair Belting.—1893.
- ROUSSEL, W. J.  
Cipher Code System.—1902.
- RUSBY, J. M.  
“Industrial Combustible Gases” (Paper).—1914.
- RUSHTON, K.  
Improvements in Trailing Trucks for Locomotives.—1910.
- RUUD, EDWIN.  
Instantaneous Automatic Water Heater.—1904.
- SCHEMERHORN, W. GEORGE.  
Folding Boat.—1891.
- SCHLINK, FREDERICK J.  
Stabilized Platform Weighing Scale.—1919.
- SCHMIDT, MAX, AND SIEBER, JOSEPH.  
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.  
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.  
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.  
“Organic Constituents in Soils” (Paper).—1912.
- SCRIPTURE, E. W.  
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.  
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.  
Super-Centrifuge.—1916.
- SHAW, H. M.  
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.  
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.  
Typewriting Machine.—1901.



- SIEBER, JOSEPH, AND SCHMIDT, MAX E.  
Movable Side-Walk.—1894.
- SKINNER, JOSHUA J.  
“Soil Aldehydes” (Paper).—1919.
- SNOOK, HOMER CLYDE.  
X-Ray System.—1919.
- SPITZGLASS, JACOB M.  
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.  
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.  
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.  
“Propagation of Electric Waves Along Wires” (Paper).—1913.
- STRADLING, GEORGE F.  
“Modern Theories of Magnetism” (Paper).—1916.
- STUMPF, J.  
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.  
Radojet Air Pump.—1920.
- TAINTOR, C. C.  
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.  
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.  
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.  
“Measurement of Gases” (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.  
Chlorinator.—1922.
- TOERRING, C. J.  
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.  
Improved Thermometer Support.—1907.
- TUCKER, W. H.  
Letter and Document Files.—1900.
- TURNER, W. V.  
“Locomotive Air-Brake” (Paper).—1911.
- TUTWILER, C. C.  
“Recovery of Gas Works by-Products” (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.  
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.  
Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B. .

“The Electric Strength of Air and Methods of Measuring High Voltage” (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

“The Annealing of Glass” (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

“Locomotive Superheaters” (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.

CERTIFICATE OF MERIT AWARDS

1885-1921.

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

“The Application of Radio to Navigation Problems” (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improved in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.

Magnetic Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.

Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

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CARROLL, W. T.

Non-Metallic Bearings.—1896.

CASTNER, H. Y.

Apparatus for the Manufacture of Sodium and Potassium.—1889.

CERASOLI, ALBERTO, AND HUMPHREY, H. A.

Hydraulic Pump.—1914.

CHABOT, CYPRIEN.

Shoe Sole Channeling Machine.—1885.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHABOT, CYPRIEN.

Shoe Sole Edge Turning Machine.—1885.

CHABOT, CYPRIEN.

Beveled Rim Watch Cases.—1886.

CHAMBERS, C.

Brick Machine.—1875.

CHAMBERS, C.

Book Folding and Pasting Machine.—1874.

CHAUVENET, WILLIAM.

Great Circle Protractor.—1857.

CHENOWETH, A. C.

Electric Conduits.—1890.

CHENOWETH, A. C.

Steel Concrete Foundation Piles.—1906.

CLARK, G. S.

Device for Safety Vaults.—1892.

CLAUD, G. M.; HESS, G. A.; FOUCHE, EDMUND.

Process of Storing Explosive Gases.—1903.

CLEBORNE, C. J.

Bedstead.—1894.

COLBY, E. A.

Electric Furnace for Melting Metals.—1909.

COLTON, SABIN W.

Improved Locks.—1848.

CONNET, FREDERICK N., AND JACKSON, W. W.

Improved Venturi Meter.—1898.

COOK, H.; CARNEY, T.; PATTERSON, H. G. & J. H.

Cash Registers.—1901.

COOPER, DANIEL.

Time Recorder.—1898.

COURTENAY, WILLIAM, AND BLAKEY, THOMAS W.

Reconstructed Granite.—1900.

COWLES, EUGENE H., AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER-COWLES, SHERARD.

Method of Depositing Metals on Metallic Surfaces.—1911.

CREHORE, A., AND SQUIER, G. O.

Polarizing Photo-Chronograph.—1896.

CROSS, C. F.; BEADLE, CLAYTON; BEVAN, E. J.

Cellulose Products.—1895.

CROSS, W. A.

Horizontal Folding Door.—1903.

CYCLOSTYLE COMPANY.

Cyclostyle.—1888.

DALE, JOHN D.

Wood Molding Machine.—1857.

DARLING, J. D.

Apparatus for Producing Metals and Nitric Acid from Fused Nitrates.—1901.

DAVIS, JOB A.

Vertical Feed for Sewing Machine.—1875.

DENISON, L. C.

Corn Sheller.—1839.

DIETZ, GUSTAV.

High Speed Photographic Between-lens Shutter.—1909.

DILKS, J.

Water Gauges.—1853.

DOBBINS, E. J.

Daylight Rod.—1914.

DOBBINS, EDWARD J., AND MOFFETT, GEORGE.

Light Projecting Glass.—1901.

DOBLE, W. A.

Tangential Water Wheel—1904.

DOCK, H.

Rivett Thread Tool.—1901.

DODGE, J. M.

Storage Structure for Coal and Analogous Material.—1904.

DODGE, WALLACE H.

System of Rope Transmission.—1891.

DOERR, JOHN H., AND WIGMORE, WILLIAM H.

Sleeping Car.—1885.

DORR, JOHN V. H.

Hydrometallurgical Apparatus.—1916.

DOWNES, L. W.

Fireproof Insulated Wire.—1905.

DRESSLER, CONRAD D'HUC.

Tunnel Kiln.—1918.

DUNCAN, JOSEPH S.

Addressograph.—1903.

DUNHAM, JOSEPH M., AND MCKEMMIL, JOHN.

Metallic Drawing Rolls.—1894.

DUNN, B. W.

Testing Machine for Measuring Intensities of Impulsive Forces.—1898.

DURKEE, G. B., AND GOLDING, JOHN F.

Expanded Metal.—1897.

DUTTON, R. & Co.

Mowing Machine.—1877.

ECKSTEIN, H. G.

Feed Water Heater.—1884.

EDISON, T. A.

Mimeograph.—1889.

EDSON, J. B.

Pressure Recording Gauge.—1894.

EHBETS, C. J.

Improved Revolver.—1890.

ELDRED, BYRON E.

Process for Flame Regulation.—1906.

ELDRIDGE, G. M.

Electro Magnetic Protector for Electric Instruments.—1884.

ELLIS, H.

Combined Calculating and Writing Machine.—1909.

ELMER AND LITTLE.

Chronometer.—1837.

EMERSON, J.

Power Scale.—1892.

EWBANK, T.

Lead Pipes.—1835.

FABER, GEORGE.

Magnetic Water Gage.—1853.

FAHY, FRANK P.

Permeameter.—1918.

FAWKES, JOSEPH W.

Steam Plow.—1859.

FELLOWS, E. R.

Machine and Cutter for Generating Gear Teeth.—1899.

FELT, D. E.

Comptometer.—1890.

FIELD, D. W., AND SPENCER, JOHN E.

Damper Regulator.—1893.

FISHER, ROBERT T.

Improved Book and Letter Typewriter.—1899.

FORTEN, R. B.

Telescope.—1840.

FOUCHE, E.; CLAUD, G. M. A.; HESS, G. M.

Process for Storing Explosive Gases.—1902.

FRAHM, HERMANN.

Speed Indicator, Frequency Teller and Revolution Counter.—1907.

FRANCIS, JEROME B.

Tooth Extractor.—1860.

FRAZER, PERSIFOR.

Apparatus for Quantitative Colorimetry.—1905.

FULLER, FRED L., AND GRISWALD, GEORGE H.

Cash Register and Indicator.—1892.

FULLER, J. E.; BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.

Refrigeration Process.—1894.

FURBISH, ZACHARY T.

Ratchet Tools.—1904.

GARROD, R. P.

Annunciators.—1891.

GATES, JOHN.

Lubricator.—1888.

GIBBONS, C. L.

Street Railway Construction.—1892.

GILLESPIE, ALFRED J.

Voting Machine.—1902.

GLIDDENS, CARLOS; SHOLES, C. L.; SOULE, S. W.

Improved Typewriter.—1875.

GODDARD, K.

Carriage Axle.—1852.

GOETZ, G. M.

Device for Anchoring Beams.—1891.

GOLDBERG, H. E., AND WAHL, J. C.

Adding Machine.—1916.

GOLDING, J. F., AND DURKEE, G. B.

Expanded Metal.—1897.

GOLDSTEIN, A.

Pneumatic Fire Alarm Telegraph System.—1895.

GOODES, E. A.

Sewing Machine.—1875.

GOODWIN, WILLIAM FARR.

Mowing Machine.—1879.

GOODYEAR, ROBERT B.

Harness Motion for Power Looms.—1875.

GOODYEAR, ROBERT B.

Shuttle Box Operating Mechanism.—1875.

GRANT, GEORGE B.

Calculating Machine.—1877.

GRANT, GEORGE B.

Calculating Machine.—1896.

GRAU, PHILIP J.

Feed Water Purifier and Heater.—1886.

GREENE, E. V.

Apparatus for Extracting Oil and Albuminoid from Corn.—1851.

GRIMES, W. C.

Water Gauge for Steam Boilers.—1851.

GRIMES, W. C.

Smut Machine.—1840.

GRISWALD, GEORGE H., AND FULLER, FRED L.

Cash Register and Indicator.—1892.

GROUPE, A. V.

Braiding Machine.—1900.

GUILLAUME, C. E.

Invar Alloy.—1914.

HADFIELD, ROBERT.

Manganese Steel.—1891.

HAHL, A. L.

Pneumatic Clock.—1901.

HAINES, ROBERT B., JR.

Automatic Micrometer Rolling Mill Plate Gauge.—1901.

HAKEWESSEL, REINHOLD, AND HENN, EDWIN C.

Automatic Screw and Metal Working Machine.—1901.

HALL, THOMAS.

Typewriter.—1884.

HALL, M. W.

Duplex Steam Pump.—1886.

HALLOCK, DAVID.

Weighing Scale.—1887.

HALLOWELL, HOWARD T.

Pressed Steel Shaft Hangers.—1906.

HAMMER, WILLIAM J.

Apparatus for Long Distance Phonographic and Telephonic Experiments.—1902.

HANNAY, J. B., AND SHEDLOCK, ALFRED.

Lucigen.—1891.

HANSON, HANS, AND HART, FREDERICK A.

Calculating and Typewriting Machine.—1915.

HARDINGE, H. W.

Conical Pebble Mill.—1915.

HARO, A LOPEX DE.

Electric Sea Compass; Automatic Electric Log Line.—1890.

HART, EDWARD.

Acid Container.—1891.

HART, FREDERICK A., AND HANSON, HANS.

Combined Calculating and Typewriting Machine.—1915.

HART, WALTER.

Hoisting Machine.—1891.

HEANY, J. A.

Enclosed Arc Lamp.—1904.

HECTROTTE, A. G.

Car Couping.—1848.

HELLINGS, J.

Mail Bag Fastener.—1890.

- HENN, E. C., AND HAKEWESSEL, REINHOLD.  
Automatic Screw and Metal Working Machine.—1901.
- HERAEUS, W. C.  
Fused Quartz Mercury Lamp.—1906.
- HERAEUS, W. E.  
Improvements on the LeChatelier Pyrometer.—1907.
- HERMAN, HENRY O.  
Star Ventilator.—1902.
- HERR, H. A.  
Liquid Extraction Apparatus.—1909.
- HESS, G. A., CLAUD, G. M. A., FOCHE, E.  
Process of Storing Explosive Gases.—1902.
- HEXAMER, C. J.  
Apparatus for Preventing and Extinguishing Fires in Grinding Mills.—  
1888.
- HEYL, HENRY R., AND BREHMER, HUGO.  
Wire Book Sewing Machine.—1883.
- HEYL, HENRY R.  
Wire Fastened Paper Boxes.—1875.
- HIGGINS, A., AND JACOBS, C. B.  
Alundum Refractories.—1909.
- HILL, T.  
Calculating Instrument.—1843.
- HOBSON, A. E.  
Hydraulic Shaping Press.—1890.
- HOLCOMB, A.  
Reflecting Telescope.—1835.
- HOPKINS, EDWARD P.  
Electric Arc Lamp.—1896.
- HOPKINS, N. M.  
Pneumatic Water Pipe Cushioning.—1900.
- HOUGH, JAMES, AND LAUGHLIN, SAMUEL.  
Drawing Tables.—1900.
- HUMPHREY, F. A.  
Improved Sawing Machine and Guide.—1901.
- HUMPHREY, H. A., AND CERASOLI, ALBERTO.  
Hydraulic Pump.—1914.
- HUTCHINS AND MABBITT.  
Tilting Chair.—1875.
- HYATT, I. S.  
Purification of Water System.—1888.
- HYATT, J. W.  
Roller Bearings.—1898.
- IHLDER, J. D.; SMITH, A. C.; SUNDH, AUGUST; OTIS, SIDNEY.  
Electric Elevator.—1902.
- IRWIN, JOHN H.  
Lantern.—1873.

- IVES, FREDERICK E.  
Isochromatic Photography.—1887.
- IVES, FREDERICK E.  
Projecting Lantern and Appurtenances.—1890.
- IVES, FREDERICK E.  
Parallax Stereogram.—1904.
- IVES, FREDERICK E.  
New Form of Replica of Rowland Diffraction Grating.—1905.
- IVES, FREDERICK E.  
Color Meter.—1907.
- JACKSON, WALTER W., AND CONNET, F. N.  
Improved Venturi Meter.—1898.
- JACOBS, C. B., AND HIGGINS, A. C.  
Alundum Refractories.—1909.
- JANDUS, WILLIAM.  
Enclosed Arc Lamp.—1895.
- JAY, PERRIE EGMOND.  
Automatic Anti-Freezing Valve.—1885.
- JENKINS, C. F.  
Motion Pictures Apparatus.—1909.
- JENKS, W.  
Fire Arms.—1840.
- JEWELL, M. R.; POWERS, T. B.; KELLY, J. F.  
Teleelectric Piano Player.—1910.
- JOHNSON, A. L.  
Bonding Joint for Electric Railways.—1896.
- JOHNSON, E. H.  
Interior Electric House Conduit.—1891.
- JONES, ALFRED C.  
Shaft Couplings.—1842.
- JONES, EVAN W.  
Underfeed Mechanical Stoker.—1904.
- JONES, H. P.  
Baling Machine.—1901.
- JONES, J. R.  
Method of and Apparatus for Axle Rolling.—1892.
- KELLY, J. F.; POWERS, T. B.; JEWELL, M. R.  
Teleelectric Piano Player.—1910.
- KEMBLE, B. H.  
Wheel Hubs.—1883.
- KENT, A. ATWATER.  
Ignition System for Automobiles.—1914.
- KITE, J. S.  
Safety Beam.—1840.
- KNEASS, S. L.  
Injector.—1901.



- KOYL, C. H.  
Parabolic Semaphore.—1889.
- KURTZ, DAVID T.  
Cap Screws and Bolts—1905.
- LA RUE, S. H.  
Stove for Soft or Bituminous Coal.—1893.
- LATTIG, J. W.  
Automatic Electric Semaphore Signal.—1904.
- LAUGHLIN, SAMUEL, AND HOUGH, JAMES.  
Drawing Tables.—1900.
- LECLERE, FRANCIS.  
Black Printing Process.—1897.
- LECLERE, FRANCIS.  
Toothed Gear Wheel—1891.
- LEONARD, H. W.  
System of Motor Control.—1902.
- LEVY, M. AND L. E.  
Screens for Photo-Mechanical Engraving.—1897.
- LEWIS, WILFRED; TABOR, HARRIS; MUMFORD, E.  
Molding Machine.—1902.
- LINCOLN, P. M.  
Synchronism Indicator.—1902.
- LITTLE AND ELMER.  
Chronometer.—1837.
- LOSS, HENRIK V.  
Solid Steel Railway Wheels Manufactured by Hydraulic Forging with Rolling.—1904.
- LOVEKIN, L. D.  
Device for Relieving Forces due to Inertia and Weight of Valve Gears.—1910.
- LOWE, J.  
Spinning Mule.—1890.
- LUNGREN, CHARLES M.  
Incandescent Gas Light.—1892.
- MACCOY, J. S.  
Pneumatic Tool.—1890.
- MCCALL, THOMAS A., AND PILLINGS, JOHN H.  
Automatic Typewriter.—1917.
- MCCAULEY, THOMAS, AND REED, C. J.  
Speed-Jack.—1907.
- MCCLELLAN, EZRA S.  
Anti-Siphon Vent.—1892.
- MCCRACKEN, EDWIN D.  
Insulated Electrical Conductors.—1896.
- MCINTIRE, C.  
Electric Wire Connectors.—1890.

McKEE, M. A.

Process of Treating Printing Plates.—1912.

McKEMMIL, JOHN, AND DUNHAM, JOSEPH M.

Metallic Drawing Rolls.—1894.

McMAHAN, J.

Stereotyping Plate.—1835.

McMULLEN, JOHN.

Machine for Knitting Stockings.—1835.

MACHLET, GEORGE, AND REICHHELM, E. P.

Apparatus for Producing Fuel Gas.—1894.

McCURDY, ARTHUR W.

Apparatus for Developing Photographic Roll Prints.—1904.

MADDOX, R. L.

Substitution of Gelatine for Collodion in Photography.—1889.

MAHAN, FRANCIS.

Measure Case Ruler.—1837.

MARCY, L. J.

Magic Lantern.—1887.

MARKS, A. A.

Artificial Limbs.—1889.

MARSDEN, M.

Corn-pith Cellulose.—1896.

MASON, A. J.

Washer Punching Machine.—1891.

MELLOR, L. B.

Device for Measuring and Recording the Variable Diameter of Tubes.—  
1903.

MERGENTHALER, O.

Linotype.—1889.

MERKET, LUZERNE, AND THOMAS, ALMER.

Tempered Copper.—1891.

MERRICK AND TOWNE.

Boring Machine.—1840.

MERSHON, R. D.

Compensated Potential Indicator.—1901.

METZLER, CHRISTIAN E., AND BURRELL, JOHN H.

Railway Signal Lantern.—1885.

MEYERS, J. G.

Mausoleum.—1889.

MEYLAN, EUGENE, AND RECKNIEWSKI, CAMILLE S.

Electric Meter.—1893.

MILLER, D. K.

Self Locking Padlock.—1883.

MILLIAU, EDWARD.

Apparatus for Analyzing Fats and Oils.—1896.

MOFFETT, GEORGE, AND DOBBINS, EDWARD J.

Light Projecting Glass.—1901.

- MOORE, D. MCFARLAN.  
Vacuum-tube Light.—1909.
- MOORE, LEE C.  
Wire Testing Machine.—1904.
- MORRIS, HENRY G., AND SALOM, PEDRO G.  
Electric Automobile.—1897.
- MORSE, EVERETT F.  
Heat Gage.—1903.
- MORSE, EVERETT F.  
Drive Chains.—1901.
- MORSELL, W. F. C.  
Complementary Color Designs and Crystal Patterns.—1894.
- MOSER, L.  
“Bohemian” Glassware.—1886.
- MOSKOWITZ, MORRIS.  
System of Car Lighting.—1900.
- MUELLER, H. C.  
Apparatus and Process for Manufacturing Mosaics.—1898.
- MUMFORD, EDGAR; LEWIS, WILFRED; TABOR, H.  
Molding Machine.—1902.
- NACKE, ARNOLD.  
Screw Cutting Attachment.—1883.
- NAGLEE, H. M.  
Flat Bar or Edge Rail for Railroad Curves.—1842.
- NERNST LAMP COMPANY.  
Incandescent Lamp.—1906.
- NICHOLS, H. B., AND VOYNOW, C. B.  
Cast Zinc Joint for Rail-Bonding.—1906.
- OLDS, CALVIN.  
Planting Machine.—1840.
- ORUM, MORRIS L.  
Improved Lock.—1885.
- ORUM, MORRIS L.  
Mandrel for Bending Metal Pipes.—1875.
- OTIS, SIDNEY; SMITH, R. C.; IHLDER, J. D.; SUNDH, AUGUST.  
Electric Elevator.—1902.
- OUTERBRIDGE, A. E., JR.  
Method of Carbonizing Fabrics and Castings Therefrom.—1888.
- OUTERBRIDGE, A. E., JR.  
Method for Investigating the Molecular Physics of Cast Iron.—1897.
- PAAROWDAKI, SPIRIDION, AND BLONDEL, ANDRE.  
Holophone Globes.—1898.
- PALMER, B. F.  
Artificial Leg.—1849.
- PALMER, FREDERICK; REYNOLDS, J. R.; TIRRELL, J. P.  
Engine Stop and Speed Limit System.—1906.

- PARKER, ZEBULON.  
Water Wheel.—1847.
- PARKINSON, EDWARD.  
Knitting Machine.—1905.
- PARSONS, L. H.  
Scale Measure.—1852.
- PATTERSON, H. G.; PATTERSON, J. G.; CARNEY, T.; COOK, H.  
Cash Registers.—1901.
- PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.  
Cash Registers.—1901.
- PAYEN, C.  
Chloride Electrical Storage Battery.—1894.
- PEALE, F.  
Coining Presses at the United States Mint, Philadelphia.—1840.
- PENTZ, A. D.  
Boring and Milling Engine.—1891.
- PERRY, N. W.  
Method of Series Electric Traction.—1894.
- PFATISCHER, MATTHIAS.  
Variable Speed Motors.—1909.
- PHELPS, L. J.  
Induction Telegraph.—1886.
- PHOENIX IRON COMPANY.  
Automatic Cut-Off Steam Engine.—1886.
- PILLINGS, JOHN H., AND MCCALL, THOMAS A.  
Automatic Typewriter.—1917.
- PONTRICHET, J.  
“Heliographic” Paper.—1894.
- POOLE AND COMPANY, J. MORTON.  
Grinding Metallic Calendar Rolls.—1875.
- POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.  
Teleelectric Piano Player.—1910.
- PRATT AND WHITNEY COMPANY.  
Taps and Gauges.—1883.
- PRATT AND WHITNEY COMPANY.  
System of Interchangeable Cut Gears.—1886.
- PRENTISS, H. S.  
Automatic Calendar.—1896.
- PRIESTMAN, W. D. AND SAMUEL.  
Steam Engine.—1894.
- PRUNTY, JOHN E.  
Relief Valve.—1875.
- PRUTZMAN, A.  
Door Lock.—1836.
- REAGAN, J.  
Grate Bars.—1908.

- RECEVEUR, P. N.  
Rose Engine (Lathe).—1853.
- RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.  
Electric Meter.—1893.
- REDDAWAY, FRANK.  
Camel Hair Belting.—1898.
- REED, CHARLES J., AND MCCAULEY, THOMAS.  
Speed-Jack.—1906.
- REICHHELM, E. P., AND MACHLET, GEORGE.  
Apparatus for Producing Fuel Gases.—1894.
- RENO, J. W.  
Escalator.—1910.
- REYNOLDS, J. R.; PALMER, FREDERICK, S.; TIRRELL, J. P.  
Engine Stop and Speed Limit System.—1906.
- RHOADS, J.  
Map for the Blind.—1840.
- RICHARDS, J.  
Solder for Aluminum.—1896.
- RICHARDS, J.  
Balance for Testing White Metal Alloys.—1901.
- RICHARDS, T. A.  
Ruling Machine.—1890.
- RICHARDSON.  
Eccentric Door Spring.—1840.
- RICHARDSON, J. H.  
Signal Lantern.—1868.
- RIDGWAY, T. S., JR.  
Transit Theodolite.—1839.
- RIDGWAY, W. H.  
Balanced Crane.—1890.
- RIEFLER, SIGMUND.  
Mercurial Compensation Pendulum.—1894.
- RITCHIE, E. S.  
Improved Rhumkorff Coil.—1860.
- rites, F. M.  
Perfecting of Shaft Governor System.—1902.
- ROEDER, F. A., AND SPRINGER, ALFRED.  
Torsion Balance.—1891.
- RONDINELLA, L. F.  
Photo-Printing Machine.—1905.
- ROOT, J. B.  
Spiral Weld Tubing.—1890.
- ROOTS, P. H. AND F. M.  
Rotary Pressure Blower.—1875.
- RORER, T. J.  
Belting.—1875.

ROSENBAUM, WALTER A.

Automatic Hydraulic Letter Copying Press.—1905.

SACHS, J.

Enclosed Fuse Protective Devices.—1903.

SALOM, PEDRO G., AND MORRIS, HENRY G.

Electric Automobile.—1897.

SARGENT, C. E.

Expansion Gas Engine.—1907.

SAYEN, H. L.

Improved Roentgen Ray Tubes.—1898.

SAXTON, J.

Reflecting Pyrometer.—1842.

SCHELLENBACH, WILLIAM S.

System of Gearing.—1902.

SCHMIDT, M. E.

Moving Platform.—1906.

SCHOOP, MAX ULRICH.

Metal Spraying Process.—1917.

SEE, H.

Hydro-Pneumatic Ash Ejector.—1904.

SEMPLE, J. B.

Shell Torch or Tracer.—1905.

SENNEFF, JACOB.

Eye-Harness for Metallic Heddle.—1853.

SEVERY, M. L.

Printing Machine.—1898.

SEYMOUR, C.

Balancer for Pulleys, Fly Wheels, etc.—1878.

SEXTON, A.

Slide Rule.—1899.

SHAW, T.

Instrument for Testing Ignitable Gases in Mines.—1889.

SHAW, THOMAS.

Gunpowder Pile Driver.—1872.

SHAW, THOMAS.

Spiral Exhaust Nozzle.—1877.

SHAW, THOMAS.

Friction Buffer.—1883.

SHAY, EPHRAIM.

Geared Locomotive.—1892.

SHEDLOCK, ALFRED, AND HANNAY, J. B.

Lamp for Engineering Uses.—1891.

SHIMER, P. W.

Combustion Crucible.—1901.

SHOLES, C. LATHAM ; GLIDDENS, CARLOS ; SOULE, SAMUEL W.

Typewriter—1875.

- SHORE, A. F.  
Scleroscope.—1909.
- SHUMAN, F. S.  
Wired Glass.—1894.
- SHUMAN, F.  
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.  
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.  
Typewriter.—1875.
- SPEIDEL, J. G.  
Hoisting Machines.—1891.
- SPELLIER, L. H.  
Electric Clock.—1887.
- SPENCER, J. E., AND FIELD, D. W.  
Damper Regulator.—1893.
- SPERRY, E. A.  
Gyroscope Compass.—1914.
- SPIELMAN, A.  
Cloth Cutting Machine.—1914.
- SPIRO, C.  
Barlock Typewriter.—1894.
- SPRATT, ORLANDS W.  
Mercury Seal Trap.—1885.
- SPRINGER, ALFRED, AND ROEDER, F. A.  
Torsion Balance.—1891.
- SQUIER, G. O., AND CREHORE, A.  
Polarizing Photo-Chronograph.—1896.
- STACKHOUSE, THOMAS H.  
Diagraph.—1895.
- STAHLBERG, C.  
Time Dating Stamp.—1891.
- STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.  
Refrigeration Process.—1894.
- STEINBART, ALFRED, AND UEHLING, EDWARD.  
Pneumatic Pyrometer.—1898.
- STEINBART, ALFRED, AND UEHLING, EDWARD.  
Gas Composimeter.—1899.
- STELLWAGON, H. S.  
Sounding Apparatus.—1848.
- STIERINGER, L.  
Improved Method of Electric Illumination.—1902.
- STREET, CLEMENT F.  
Locomotive Stoker.—1915.
- STRICKLAND, W.  
Substitution of Lime for Salt for Preserving Lumber.—1840.

- SUNDH, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.  
Electric Elevator.—1902.
- SWEETLAND, ERNEST J.  
Filter Press—1918.
- SWENSON, MAGNUS.  
Round Lap Baling Cotton Compress.—1900.
- TABER, HARRIS; LEWIS, WILFRED; MUMFORD, E.  
Molding Machines.—1902.
- TAINTER, SUMMER, AND BELL, CHICHESTER, A.  
Apparatus for Recording Sound.—1900.
- TALBOT, E.  
Improved Methods in the Manufacture of Steel.—1908.
- TATHAM, B., AND BRITTIN, J. W.  
Safety Catch for Elevators.—1875.
- TATTERSALL, ALFRED R.  
Flour Mill.—1917.
- TAYLOR, C. M., JR.  
Absorption Process for Butter Making.—1903.
- TEAL, C. A.  
Portable Hoist.—1889.
- THOMAS, ALMER, AND MERKET, LUZERNE.  
Tempered Copper.—1891.
- THOMSON, ELIHU.  
Electric Welding.—1889.
- THOMSON, ELIHU.  
Constant Current Arc Light Transformer.—1901.
- THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.  
Refrigeration Process.—1894.
- THUM, CHARLES D.  
Varnish Brushes.—1854.
- TIRRILL, A. A.  
Voltage Regulator.—1910.
- TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.  
Engine Stop and Speed Limit System.—1906.
- TOWNSEND, ISAAC.  
Tent Fastening.—1885.
- TWEDDELL, R. H.  
Method of Applying Hydraulic Power to Mechanical Work.—1894.
- TYLER, PHILOS B.  
Shifting Gauge Cock for Steam Boilers.—1835.
- TYSON, CHARLES.  
Machine to Unite Uppers to the Soles of Shoes.—1875.
- UEHLING, EDWARD, AND STEINBART, ALFRED.  
Gas Composimeter.—1899.
- UEHLING, EDWARD, AND STEINBART, ALFRED.  
Pneumatic Pyrometer.—1898.



- VAN KANNEL, T.  
Storm Door.—1890.
- VAUCLAIN, SAMUEL M.  
Truck Wheel Centres.—1891.
- VILLEROI, M.  
Telescope.—1849.
- VOYNOW, C. B., AND NICHOLS, H. B.  
Cast Zinc Joint for Rail Bonding.—1904.
- WAHL, J. C., AND GOLDBERG, H. E.  
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THE physical phenomena of the earth's atmosphere are exceedingly numerous and of great importance. Nevertheless, the explanations, even of those well understood, still remain scattered through many books and numerous journals. Perhaps this is because some of the phenomena have never been explained, and others but imperfectly so, but, however that may be, it is obvious that an orderly assemblage of all those facts and theories that together might be called the *Physics of the Air* would be exceedingly helpful to the student of atmospheric. An attempt to serve this useful purpose, begun in a course of lectures at the San Diego Aviation School (Rockwell Field) in 1914, led to the production of the following chapters—revised and reprinted from the *Journal of The Franklin Institute*, 1917, 1918, 1919, 1920.

The author begs to express his indebtedness to Prof. C. F. Marvin, Chief of the United States Weather Bureau, for numerous helpful criticisms; to Dr. C. F. Brooks, Editor of the *Monthly Weather Review*, for many excellent suggestions; to Prof. C. F. Talman, Librarian of the United States Weather Bureau, for valuable aid in locating original sources; and to Major R. B. Owens, D. S. O., Secretary of The Franklin Institute, for his encouraging interest in the work and invaluable attention to the details of its publication.

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 GRIFFITH, ROBERT E., 1827  
 GROVES, DANIEL, 1824-1827  
 HALL, CLARENCE A., 1922-  
 HAND, JAMES C., 1845-1846  
 HANSELL, WILLIAM S., 1827  
 HARDING, GEORGE, 1864-1865  
 HARKER, JOSHUA G., 1831-1836  
 HARPER, JAMES, 1824-1826  
 HARRIS, WILLIAM, 1860-1863  
 HARRISON, ALFRED C., 1895-  
 HARRISON, C. LELAND, 1899-1902  
 HARRISON, JOHN, 1824-1829  
 HARRISON, JOSEPH, JR., 1854, 1856-1859  
 HART, SAMUEL, 1865-1870  
 HAVILAND, JOHN, 1824-1826  
 HAYS, ISAAC, 1840-1841  
 HAYWARD, NATHAN, 1917-  
 HELLER, CHARLES S., 1879-1880  
 HELME, WILLIAM, 1869-1888  
 HENDERSON, GEORGE R., 1915-1921  
 HERSE, GEORGE P., 1851  
 HEXAMER, CHARLES A., 1904-  
 HEYL, HENRY R., 1879-1895, 1898-1909  
 HOADLEY, GEORGE A., 1911-  
 HORN, HENRY, 1824  
 HORSTMANN, WILLIAM J., 1865-1868  
 HOUSTON, EDWIN J., 1874-1897  
 HOWARD, GEORGE C., 1855-1858  
 HOWE, HERBERT M., 1898-1900  
 HOWSON, CHARLES HENRY, 1903-1907  
 HOWSON, HENRY, 1898-1903  
 HUFTY, SAMUEL, 1834-1850  
 HUMPHREYS, SAMUEL, 1826  
 HUNTER, JAMES, 1864  
 HUTCHINSON, CHARLES H., 1888-1890  
 HUTCHINSON, JAMES, 1841-1842  
 HUTCHINSON, JOSEPH, 1860-1863  
 JAYNE, HARRY W., 1891-1910  
 JENNINGS, W. N., 1896  
 JOHNSON, LAWRENCE, 1855-1859  
 JONES, THOMAS P., 1826  
 JONES, WASHINGTON, 1859-1895, 1897-1900  
 KATEZ, I., 1824  
 KEATING, WILLIAM H., 1824-1826, 1830-1840  
 KELLER, HARRY F., 1914-  
 KELLY, HENRY H., 1851  
 KING, ROBERT P., 1851  
 KIRK, CHARLES H., 1830  
 KIRKPATRICK, GEORGE E., 1911-1914  
 KLUMPP, JOHN BARTLEMAN, 1923  
 KNEASS, WILLIAM, 1825  
 KNIGHT, DANIEL R., 1845  
 KRUMBHAAR, ALEXANDER, 1898-1911  
 KUHN, C. HARTMAN, 1896-1905  
 LAMBERT, WM. H., 1906  
 LESLEY, ROBERT W., 1913-  
 LE VAN, W. BARNET, 1864-1876  
 LEVY, LOUIS E., 1903-1915  
 LEWIS, ENOCH, 1868-1894  
 LEWIS, HARVEY, 1824-1827  
 LEWIS, MORDECAI D., 1828-1836  
 LINDSAY, JOHN, 1843  
 LINDSAY, ROBERT, 1834-1836  
 LINNARD, JAMES M., 1836-1838  
 LINVILLE, J. HAYES, 1868  
 LONGSTRETH, CHARLES, 1903-1907  
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897  
 LOUD, THOMAS, 1829-1831  
 LOVE, WILLIAM H., 1859  
 LUCAS, JOHN, 1888-1894  
 LUKENS, ISAIAH, 1828  
 LUKENS, JAWOOD, 1902-1908  
 LYMAN, BENJAMIN S., 1901-1902  
 MCALPINE, JAMES, 1825-1828  
 MCCAFFREY, E. V., 1910-  
 MCCAMBRIDGE, RICHARD, 1876



**MANAGERS—(Continued)**

- SELLERS, COLEMAN, 1862-1866, 1875-1905  
 SELLERS, COLEMAN, JR., 1906-1911  
 SELLERS, WILLIAM, 1857-1861, 1867-1892  
 SHAIN, CHARLES J., 1884-1887  
 SHINN, EARLE, 1836-1837  
 SLOAN, SAMUEL, 1864  
 SMITH, CHARLES E., 1852-1855  
 SMITH, HASELTINE, 1922-  
 SOUDER, JACOB, 1828  
 SPANGLER, HENRY W., 1891-1893  
 STEVENSON, WILLIAM, JR., 1828  
 STEWART, THOMAS S., 1842-1850, 1852-1863  
 STRICKLAND, WILLIAM, 1828  
 STRUTHERS, JOHN, 1827-1849  
 TABER, GEORGE, 1839-1842  
 TATHAM, WILLIAM P., 1870-1878, 1886-1887  
 THOMPSON, AMBROSE W., 1839-1843  
 THOMSON, ELIHU, 1878-1881  
 THORNE, WILLIAM H., 1881-1897  
 THORNLEY, JOHN, 1851  
 TILGHMAN, BENJ. C., 1871-1875  
 TOPPAN, CHARLES, 1831-1832  
 TOWNE, JOHN H., 1840-1857, 1869  
 TOWNSEND, EDWARD Y., 1866-1867  
 TRACY, ELIASHIB, 1851  
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857  
 TRAUTWINE, JOHN C., JR., 1891-1895  
 TREGO, CHARLES B., 1837-1846  
 TREVOR, JOHN B., 1832  
 TROTH, HENRY, 1837-1841  
 TRYSON, GEORGE W., 1831-1833  
 TUTWILER, C. C., 1920-  
 TYLER, RUFUS, 1826-1837  
 VAUCLAIN, SAMUEL M., 1898, 1906  
 VAUX, GEORGE, JR., 1898-1899  
 WALLIS, J. T., 1923-  
 WALTER, JOSEPH S., JR., 1834-1837  
 WALTER, THOMAS U., 1829-1831, 1840-1851  
 WARDER, WILLIAM S., 1825-1827  
 WARNER, JOHN S., 1837-1843  
 WEAVER, JACOB, 1856-1857  
 WEAVER, JOHN J., 1880-1891  
 WEIGHTMAN, WILLIAM, 1862-1863  
 WETHERILL, CHARLES, 1835  
 WETHERILL, J. P., 1902  
 WETHERILL, JOHN P., 1824-1825  
 WETHERILL, WILLIAM, 1832  
 WETHERILL, WILLIAM C., 1916-  
 WEYGANDT, THOMAS J., 1851-1863  
 WHARTON, WILLIAM, JR., 1871  
 WHITAKER, GEORGE P., 1851-1852  
 WHITE, CHARLES H., 1828-1835  
 WHITE, SAMUEL S., 1864-1867  
 WHITNEY, ASA, 1846-1850  
 WHITNEY, GEORGE, 1858-1860  
 WHITNEY, JAMES S., 1862-1863, 1865-1869  
 WHITNEY, JOHN R., 1861  
 WICKHAM, M. T., 1824  
 WIEGAND, JOHN, 1831-1853  
 WIEGAND, S. LLOYD, 1864, 1890-1893  
 WILLIAMS, EDWARD H., 1871-1872  
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863  
 WILSON, JOSEPH M., 1869-1886  
 WILSON, O. HOWARD, 1864-1869  
 WOLBORN, CORNELIUS A., 1844-1850  
 WOLF, OTTO C., 1897-1913  
 WOOD, ALAN, 1845-1863  
 WOOD, SAMUEL R., 1824-1825  
 WOOD, WALTER, 1903-1912  
 WOOTTEN, JOHN E., 1860-1862  
 YARDLEY, WILLIAM, JR., 1829  
 YEAGER, JOSEPH, 1832  
 YOUNG, ANDREW, 1828-1830



## PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS

1834-1923

BACHE, ALEXANDER D., 1834-1836, 1839-1844	HOADLEY, GEORGE A., 1911-1912
BARNES, JAMES, 1922-1923	KOENIG, G. A., 1888-1889
BEARDSLEY, ARTHUR, 1892-1895	LEVY, LOUIS E., 1901-1902
BILGRAM, HUGO, 1906-1907	LEWIS, WILFRED, 1912-1913
BONINE, CHARLES E., 1916-1917	MARBURG, EDGAR, 1899-1900
CHRISTIE, JAMES, 1897-1898	MARKS, W. D., 1881-1882, 1887-1888
CLAMER, G. H., 1915-1916	MASLAND, CHARLES W., 1921-1922
CONARD, THOMAS P., 1902-1903	McCONNELL, JACOB Y., 1909-1910
CREIGHTON, H. JERMAIN, 1918-1919	ORR, HECTOR, 1880-1881
CRESSON, J. C., 1844-1874	PATTERSON, R. M., 1836-1839
CRISFIELD, J. A. P., 1913-1914	PENROSE, CHARLES, 1920-1921
ELDRIDGE, G. MORGAN, 1896-1897	ROGERS, JAMES S., 1908-1909
FRANKLIN, BENJAMIN, 1919-1920	RONALDSON, CHARLES E., 1903-1904
FULWEILER, W. H., 1923-	RONDINELLA, L. F., 1898-1899
GOLDSMITH, EDWARD, 1905-1906	SARTAIN, SAMUEL, 1895-1896
GRIGGS, WILLIAM O., 1907-1908	SELLERS, COLEMAN, 1875-1880
HAUPT, LEWIS M., 1904-1905	SPANGLER, H. W., 1890-1891
HENDERSON, GEORGE R., 1914-1915	SPENCER, THOMAS, 1910-1911
HEYL, HENRY R., 1882-1887, 1893-1894, 1900-1901	WETHERILL, WM. CHATTIN, 1917-1918
	WIEGAND, S. LLOYD, 1889-1890, 1891- 1892

## THE INSTITUTE'S ACTIVITIES

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THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the Museum of Models and Historical Apparatus.

### THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.



This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1,000 discoveries, processes, and inventions.

## THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.



This committee was appointed on March 4, 1824 and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-five years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its School has been suspended.

## LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute,



eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

## MODELS AND HISTORICAL APPARATUS

This collection includes the electrical machine used by Dr. Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Dr. Priestley's air pump, brought by him to America in 1794; odometre used by Dr. Franklin when postmaster general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1." locomotive built for the Stockton and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.





Dr. William H. Keating, Professor of Mineralogy and Chemistry delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock The Corner Stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Revd. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone, a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high, who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Munroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

3 Coins of the United States 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824 and incorporated the 30th day of March, 1824.



1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the Committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the JOURNAL of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steam boats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Professor Walter R. Johnson, Matthias W. Baldwin Frederick Graff and Isaiah Lukens. While the work of the Committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the Committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the Committee with its extensive report appeared in the issues of the JOURNAL of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May 1836, and the



the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, gingham, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical apparatus, harness, etc. A chandelier with thirty-eight lights made for the Senate Chamber of the State of Mississippi was one of the striking exhibits.

1839. The JOURNAL for November, 1839 contained a full translation by Professor John F. Frazer of the paper "Practical Description of the Process Called the Daguerreotype, which Consists in the Spontaneous Reproduction of the Images of Natural Objects in the Camera Obscura, not with Their Colours, but with Great Delicacy in the Gradation of Tints" presented to the French Academy by Daguerre.

1840. A detailed review of Dr. Alexander Dallas Bache's report on education in Europe to the Trustees of Girard College for Orphans appeared in the JOURNAL for January, (the report, covering nearly seven hundred pages, was made for use in connection with the organization of Girard College, of which Dr. Bache was President).

October 7 to 21 inclusive, eleventh exhibition of domestic manufactures held in Masonic Hall. Silver medals were awarded for cotton and woolen goods, specimens of iron and steel, hardware and cutlery, a cooking stove, a piano, wall paper, etc. Over one thousand exhibits.

1842. Samuel V. Merrick elected president of the Institute.

October 18 to 31 inclusive, twelfth exhibition of American manufactures held in the Philadelphia Museum Building, northeast corner of Ninth and Sansom Street and Welch's Olympic Circus, Walnut Street west of Eighth. No exhibition passed this in point of quality. About nine hundred exhibits.

1843. A request from City Councils for information on the best modes of paving highways. This question was referred to the Committee on Science



In 1851 a room was leased at Number 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin-ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock Street. Premiums were offered for perfumery and soaps, straw goods, chemicals, furs, saddlery and harness, leather, dental materials, surgical instruments.

1855. John C. Cresson elected president of the Institute.

1856, November 11 to 29 inclusive, twenty-fifth exhibition of American manufactures held in Dr. Jayne's building on Dock Street. Silver medals were awarded for specimens of rolled iron, hardware, stoves and heaters, cabinet-ware, lamps and gas fixtures, silverware and jewelry, cotton and woolen goods, chemicals, etc. 1226 exhibits.

1858, October 15 to November 13, twenty-sixth annual exhibition of American manufactures held in the State Armory Building and adjacent grounds (Sixteenth and Filbert Streets). Awards were made for musical instruments, books, stationery, printers' type and materials, boots and shoes, needlework, coachwork, dental materials, philosophical apparatus, glass and china, lamps and gas fixtures, machinery, etc. A special pamphlet report on the sewing machines deposited at this exhibition was published in 1859.

1863. The Guardians of the Poor requested the Institute to communicate to them the most efficient means of protecting the Alms House Buildings from lightning.





A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this Committee resulted in the passage, by Congress, on March 3, 1871, of An Act to Provide for celebrating the 100th Anniversary of American Independence by holding an international Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1870. Dr. Coleman Sellers elected president of the Institute.

1871. Dr. William H. Wahl elected Secretary of the Institute.

The Committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the JOURNAL for August 1871. The concluding report was published in August 1872 and was fully discussed at the Stated Meeting of the Institute held in October 1872 (J. F. I., December 1872, vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873 and appear in the JOURNAL for December 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Professor J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (J. F. I., Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Professor Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874 the Legislature passed a bill providing for a state survey which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the JOURNAL contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the Committee.

At the Stated Meeting of the Institute held March 19, 1873 it was resolved, to recommend and petition the legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or



intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the City as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the water department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the City and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883 and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without Federal or State aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. 216 exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen,



Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools" appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. John Birkinbine elected president of the Institute.

The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to cooperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the cooperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the President of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897 and January and February, 1898.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special Committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS. It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and



WHEREAS, It is the present established policy of the General Government to provide ample facilities for the water-borne commerce of the United States and to emancipate inter-state commerce from the obstructions imposed by tolls or restricted canals under private or corporate control,

WHEREAS, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six feet minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

*Resolved*, That a Committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1907. Dr. Walton Clark elected president of the Institute.

1909. James Christie elected secretary of the Institute.

1910. Dr. Robert B. Owens elected secretary of the Institute and appointed editor of the JOURNAL.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the cooperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

The Board of Associate Editors of the JOURNAL created.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition.





# CHARTER AND BY-LAWS

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## THE FRANKLIN INSTITUTE

### OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the said officers shall be elected at an annual meeting of the said corporation, to



SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly



vote of two-thirds ( $\frac{2}{3}$ ) of the members present at any regular or special meeting of the Board of Managers; *provided*, that they shall not be obliged to sell or convey unless a majority of their own Board shall also approve.

SEC. 4. Said Trustees shall not be confined to legal investments, but shall have full power to invest in any real property, improvements and alterations, and in any securities, other than shares of stock, or unusual personal obligations, which to them may seem advisable.

SEC. 5. Said Trustees shall have power to appoint agents to act for them, and for the acts of such agents they shall not be personally responsible where they have exercised ordinary prudence in selecting them.

SEC. 6. Said Trustees shall have power to carry into effect any special trusts upon which any property may be held by them. They shall pay out all necessary and proper costs, charges and expenses, and from time to time shall pay over the net income to the Board of Managers, to be applied by them to the uses of the Institute in accordance with the terms of the trusts from which the income is derived.

SEC. 7. At the annual meeting of the Board of Managers in each year, said Board of Trustees shall present a report of their proceedings and a detailed statement of their receipts and expenditures for the year. An approval of such account shall be final and conclusive, and shall bar any right to demand any other or further accounting.

SEC. 8. The Board of Trustees, at a meeting of the members of the Institute, called after three (3) months' special notice, at which the holders of nine-tenths ( $\frac{9}{10}$ ) of the whole outstanding shares of stock shall vote affirmatively, may convey all property, real and personal, in them vested, to the Institute, free and clear of all trusts; *provided*, that there be no specific trusts violated by such conveyance, and that all the members of said Board, as the same shall then be constituted, shall approve of such conveyance.

## ARTICLE II.—*Stock.*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, viz.:—

*First Class.*—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers, managers and auditors, upon the payment of One Dollar upon each share of stock on which they may desire to vote; *provided, however*, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.



SEC. 4. Non-resident annual contributors shall pay an entrance fee of Five Dollars and annual dues of Five Dollars.

SEC. 5. Associate members shall be over seventeen and under twenty-five years of age. They shall have the right to attend all meetings of the Institute, use the library, receive the JOURNAL and serve upon committees, but they shall not have the right to vote or to hold office. They shall pay annual dues of Five Dollars. The term of an associate member shall be limited by the age of twenty-five years, after which he shall become an annual contributor with the dues and privileges of that class and he shall be duly notified of the transfer.

SEC. 6. Annual contributors, whether resident, non-resident or associate members, shall be elected by the Board of Managers.

SEC. 7. Honorary and Corresponding Members shall be nominated by the Board of Managers, and shall require for their election four-fifths of the votes of the members present, at any meeting of the Institute at which their nomination may be acted upon. They shall pay no dues.

SEC. 8. Life members, whose membership shall not be transferable, may be elected by the Board of Managers upon the payment of Two Hundred Dollars in any one year.

Non-resident Life members may be elected in the same way upon payment of Seventy-five Dollars in any one year.

SEC. 9. A permanent membership, which may be transferred by will or otherwise, subject to the approval of the Board of Managers, may be granted by the Board of Managers to any one who shall contribute to the Institute for that purpose the sum of One Thousand Dollars in any one year.

SEC. 10. Non-resident members shall be those who reside permanently at a distance not less than twenty-five miles from Philadelphia. Transfers of membership from the resident to non-resident class may be granted by the Board of Managers at its discretion in cases of temporary absence of a member from the city for a period of not less than one year.

SEC. 11. Members shall be entitled to a Certificate of Membership on payment of One Dollar.

SEC. 12. Resignations of membership shall be made to the Board of Managers in writing, but shall not be accepted until all dues, fines, and arrears of dues and current dues at the annual rate up to the date of resignation, shall have been paid, and books and tickets returned.

#### ARTICLE IV.—*Payments of Dues.*

SECTION 1. The annual payment of fees for membership shall be due and payable on the first of October in each year, in advance; but all members elected after the 31st of March in each year shall pay, in advance, for the current year, one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Actuary. Should such dues not be paid when they become six months in arrears, the privileges of membership shall by that fact be suspended. When nine months in arrears such member shall be





return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 4. On the date of the annual election, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P. M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

#### ARTICLE VII.—*President.*

It shall be the duty of the President, or, in his absence, of one of the Vice-Presidents, in order of seniority of election, or, in their absence, of a President to be chosen *pro tempore*, to preside at all meetings of the Institute and of the Board of Managers.

#### ARTICLE VIII.—*Secretary.*

SECTION 1. The Secretary of the Institute shall be a person of scientific attainments. He shall receive such salary as may be fixed by the Board of Managers.

SEC. 2. He shall have general charge and supervision, subject to the Board of Managers, of all the work of the Institute, and of its library, museum, laboratories, and property in general.

SEC. 3. He shall keep the minutes of all meetings of the Institute; and shall perform all the duties usually pertaining to the office of secretary.

SEC. 4. He shall be *ex-officio* a member of the Board of Managers and of all standing committees of the Institute.

SEC. 5. As *ex-officio* Secretary of the Committee on Science and the Arts he shall attend all meetings of that Committee and keep the minutes thereof. He shall also attend meetings of sub-committees at which his attendance has been requested, and when desired shall aid sub-committees in making searches and in the examination of authorities, documents, apparatus, etc.

Two weeks before each stated meeting of the Committee he shall report to its Chairman the status of all investigations pending before the sub-committees.

He shall also perform any other duty that may tend to advance the work of the Committee.

With the approval of the Board of Managers he may appoint an assistant to perform some, or all of his duties as Secretary of this Committee.

#### ARTICLE IX.—*Treasurer.*

It shall be the duty of the Treasurer to receive from the Board of Trustees all funds, which they may pay over to the Board of Managers in



at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE XII.—*Committees of the Institute.*

SECTION 1. There shall be the following Standing Committees, each to consist of ten members, to be appointed by the President, at the first meeting after the annual election, who may be aided in his choice by nominations made at the annual meeting. All members notified of their appointment to any committee, if they do not decline before the next stated meeting, shall be considered members thereof:—

1. On the Library.
2. On the Museum.
3. On Meetings.

SEC. 2. There shall be a Committee on Science and the Arts, consisting of sixty members of the Institute, who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them and to sustain by their labors the scientific character of the Institute.

They shall be elected by the Board of Managers at its stated meeting on the fourth Wednesday of January, twenty members being elected each year to serve for three years.

The Secretary shall report to the Board of Managers at said meeting the number of vacancies on the Committee from any cause, and the names of those whose terms expire that year, together with the record of their attendance at meetings of the Committee, and a brief summary of their participation in the work of the Committee and its sub-committees. Vacancies occurring during any year may be filled by the Committee itself by election of members to serve until the following January.

Within one month after the Annual Election, the Committee shall hold a meeting at which it shall elect a Chairman for the current year.

It shall be the duty of the Committee to investigate and report upon any subject referred to it by a vote of the Institute, or any Section thereof, and at its discretion to investigate other subjects on application.

Applications for the examination of any subject shall be made to the Committee, either by recommendation of the Institute, or any Section thereof, or by requests from inventors or others, under the regulations of the Committee.

It shall also be the duty of the Committee to make or recommend the award of medals and other forms of recognition established by, or in charge of, the Institute.

Sub-committees to examine any subject shall be appointed by the Chairman of the General Committee from its membership, but they may include a minority of persons who are not members of the General Committee or of the Institute, but whose expert services are desired in the examination.

Reports of sub-committees shall be made to the General Committee in writing.



ARTICLE XIV.—*Order of Business.*

SECTION 1. The stated meetings of the Institute shall be held at the hour of 8 o'clock P. M.

SEC. 2. The order shall be as follows:

1. Reading of the Minutes.
2. Reports from the Board of Managers.
3. Reports from the Standing Committees, etc.
  - (1) On the Library.
  - (2) On the Museum.
  - (3) On Meetings.
  - (4) On Science and the Arts.
4. Reports from Special Committees.
5. The paper announced for the evening.
6. The Secretary's report.
7. Deferred business.
8. Consideration of new business.

SEC. 3. At the annual meeting, the tellers' report may be received and read by the Secretary immediately after the conclusion of any number of the order of business.

SEC. 4. The order of business may be altered for any meeting by a vote of two-thirds of the members present thereat.

ARTICLE XV.—*Rules.*

The Institute, at its meetings, shall be governed by Roberts' Rules of Order.

ARTICLE XVI.—*Organization and Government of Sections.*

SECTION 1. For the promotion and encouragement of manufactures and the mechanic arts, as well as of the sciences connected with them, members of the Institute may form sections and hold meetings in such rooms as may be provided for them by the Board of Managers. These sections shall be constituted as hereinafter provided, and shall have precedence in the order of their formation.

SEC. 2. Any number of members, not less than twelve, may constitute a section.

SEC. 3. Members desiring to form a section shall make written application to that effect to the Committee on Sectional Arrangements, which committee shall report such applications to the Board of Managers.

If the application shall be approved by the Board of Managers, the section shall be established and the names of the petitioners shall be recorded on the minutes as the founders of that section, and shall be reported by the Board of Managers to the Institute at its next meeting. Whenever the petitioners shall have organized, they shall report such organization, with the names of their officers, to the Committee on Sectional Arrangements. But if they shall fail to organize such section within six months after the date of said approval, or if an established section shall fail to make a report of its proceedings to the committee during any period of twelve months, it



ARTICLE XVII.—*Amendments.*

Proposals for amendments to these By-Laws shall be presented in writing, signed by two members in good standing, at any stated meeting of the Institute. By a majority vote of the members present at this meeting they may be considered, amended, referred, postponed, rejected, or ordered to be voted upon at the date of the next stated meeting, until which time they shall be posted at the Institute. The final vote upon amendments shall be by ballot, and if two-thirds of the votes cast are in favor of any proposed amendment, it shall be declared adopted; except that amendments to Article II, relating to capital stock, must (subsequently) be ratified by a majority of the stock represented at a meeting specially called for this purpose.

## BY-LAWS OF THE BOARD OF MANAGERS

(*As Amended June 8, 1910.*)

SECTION 1. *Officers.*—The President of the Institute, or, in his absence, the Vice-President, in order of seniority of election, or in the absence of both, a member elected *pro tempore*, shall preside at all meetings of the Board. Records of its proceedings shall be kept by the Actuary.

SEC. 2. *Meetings.*—The Board shall hold a meeting for the purpose of organizing, electing a Secretary, and a Committee on Science and the Arts; and appointing an Actuary, Standing Committees, etc., on the fourth Wednesday in January, and regular meetings on the second Wednesday of each month, at 3.30 o'clock P. M.

SEC. 3. Special meetings may be called by the President at his discretion, and shall be called on written request of five members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Actuary.

SEC. 4. *Actuary.*—An Actuary shall be appointed by the Board at their first meeting after the annual election. He shall keep a correct record of their proceedings; keep a roll of the members, and note their attendance thereon; give notice of all meetings of the Board, and of Committees, delivered at least two days prior to the day of meeting; act as Secretary of the following Standing Committees of the Board: on Election and Resignation of Members; on Stocks and Finance; on Exhibitions; on Endowment. He shall notify all committees of the Board of their appointment. He shall collect and receive all moneys due to the Institute, and hand them over to the Treasurer; shall act as agent of the JOURNAL of the Institute, and shall transact such other business of the Institute as the Board shall direct. In all matters he shall be subject to the direction and control of the Board, and he shall receive such yearly compensation as they may determine.

SEC. 5. *Secretary.*—The Secretary of the Institute shall be *ex officio* a member of and act as secretary of the following Standing Committees of the Board: on Instruction; on Publications; on Sectional Arrangements; Executive.







## AWARDS BY THE INSTITUTE

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The following awards are made by The Franklin Institute:

**The Franklin Medal.**  
**The Elliott Cresson Medal.**  
**The Howard N. Potts Medal.**  
**The Edward Longstreth Medal.**  
**The Certificate of Merit.**  
**The Boyden Premium.**

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

**The Franklin Medal** (Gold Medal and Diploma).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

**The Elliott Cresson Medal** (Gold Medal and Diploma).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

**The Howard N. Potts Medal** (Gold Medal and Diploma).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

**The Edward Longstreth Medal** (Silver Medal and Diploma).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the



At the Stated Meeting of the Board of Managers, February 11, 1914, the above offer was accepted, and its acceptance was confirmed to Mr. Insull in the following resolutions:

*"Resolved*, That the Board of Managers of The Franklin Institute of the State of Pennsylvania accept the offer of Mr. Samuel Insull to establish The Franklin Medal, under the conditions named in his letter of December 23, 1913.

*"Resolved* further, that it is the sense of the Board of Managers of The Franklin Institute that Mr. Insull, in founding this Medal, has rendered a notable service in stimulating workers in Physical Science and Technology and has extended materially the useful activities of the Institute.

*"Resolved* further, that the thanks of the Board of Managers of the Institute be, and are hereby, extended to Mr. Insull for his generous and greatly appreciated action.

*"Resolved* further, that an engrossed copy of these resolutions be forwarded to Mr. Insull."

On March 24, 1914, Mr. Insull forwarded his check for six thousand dollars, and the following deed was duly executed and delivered:

KNOW ALL MEN BY THESE PRESENTS, That THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, hereinafter named The Franklin Institute, for and in consideration of the sum of Six Thousand (\$6,000) Dollars to it in hand paid by Samuel Insull, Esq., the receipt whereof is hereby acknowledged, does hereby certify and declare that it holds and will use said sum of money for the following uses, intents and purposes, and upon the following perpetual trusts, that is to say:

1. To expend One Thousand (\$1,000) Dollars, or so much thereof as may be necessary, for the purpose of paying for the design of a medal, and the necessary dies and diploma plates for the purposes hereinafter set forth.

2. To invest and keep invested the balance of said sum, and from the income derived from such investments from time to time to strike off and award medals from said design to workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Board of Managers of said The Franklin Institute, have done most to advance our knowledge of physical science or its application. Should the income derived from this fund be more than necessary for the purposes aforesaid, the said The Franklin Institute may, in its discretion, award so much of the surplus, as its Board of Managers deems wise, as premiums to accompany said medals.

3. The fund thus set apart shall be known as "The Franklin Medal Fund" (Founded January 1, 1914, by Samuel Insull, Esq.).



sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

**The Howard N. Potts Medal.**—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

“I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts.”

**The Edward Longstreth Medal.**—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

*“Resolved,* That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

*“Resolved,* That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose.”

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, “The Edward Longstreth Medal of Merit, Founded





# REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

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## ARTICLE I.—*Investigations.*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. Any applicant for investigation of a subject will be furnished by the Secretary with a copy of the regulations governing investigations.

SEC. 4. An application for investigation shall be made in writing on a blank, substantially like "Form A" below, which may be obtained from the Secretary. This application shall be addressed to the Secretary, who will upon receipt refer it to the Sub-Committee on New Subjects and Preliminary Examination; this sub-committee shall recommend to the Committee its acceptance or rejection, upon which the Secretary shall notify the applicant accordingly.

SEC. 5. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for any of the awards in the gift, or under the recommendation, of the said Committee, unless the subject for award be referred to the Committee by a vote of the Institute.

## ARTICLE II.—*Meetings of the Committee.*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P. M. on the first Wednesday of each month, excepting July and August.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meeting the Committee shall proceed in the following

### *Order of Business:*

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Reading of correspondence.



duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to co-operate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each April by the Chairman from the membership with the consent and approval of the Committee, a sub-committee styled the "Sub-Committee on Literature." It shall be the duty of this sub-committee to examine carefully all papers that have been presented to the Institute and published in its JOURNAL during the current year, and to report to the Committee not later than the following April meeting which of these papers deserve the award of, viz.:

1. *The Howard N. Potts Medal;*
2. *The Certificate of Merit.*

The Institute, through the Committee, may award said medals to the authors of papers so recommended, except that it shall not so award more than one Potts Medal in any one year.

The Sub-Committee on Literature shall also consider any publication or treatise devoted to science or the mechanic arts, submitted by the Committee, and if in its judgment said work appears to be of unusual merit it may recommend that its author be awarded the Potts Medal, provided that such medal shall not be so awarded more than once in any one year.

Advertisement of these awards shall not be required.

SEC. 3. There shall be appointed annually by the Chairman from the membership a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

#### ARTICLE V.—*Sub-Committees on Investigation of Applications.*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to each member thereof giving the names of the members of the sub-committee and setting forth the regulations governing investigations.

SEC. 4. No person shall be a member of a sub-committee on investigation who is interested in the issue.

SEC. 5. After a subject has been assigned to a sub-committee for investigation it shall not be withdrawn without the consent of the Committee.



SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendation may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the chairman of the sub-committee, but without materially changing its meaning or effect. The Secretary and chairman may be assisted in this work by the Publications Committee of the Institute, or by an editing committee appointed by the Chairman of the Committee.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

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*Secretary.*

SEC. 9. Reports must be in the Secretary's hands at least one week previous to the stated meeting at which they are to be presented.

SEC. 10. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of it may be furnished the applicant, who may make any explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 11. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and fiscal action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of after first reading.



SEC. 4. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Edward Longstreth Medal shall be conclusive without advertisement.

SEC. 5. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Certificate of Merit shall be conclusive without advertisement.

ARTICLE XI.—*Protests.*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XII.—*Institute Reports.*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C below. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. It shall be the duty of the Secretary to furnish applicants for investigation with a copy of the Institute's Report.

ARTICLE XIII.—*Amendments to Regulations.*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

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A special committee, appointed for the purpose of preparing a memorandum covering the practice of the committee in the matter of recommending the different awards available to the Institute, presented a detailed report at the Stated Meeting on September 1, 1920, of which the following are the conclusions:

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition but your Committee is of the opinion that future awards might be made with the following general understanding:





IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B  
(Sub-committee Report Form)  
THE FRANKLIN INSTITUTE  
OF THE  
STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....  
Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the {  
discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... your sub-committee recommends  
the award of ..... to ..... of .....

Respectfully submitted,

..... Chairman.

.....

.....

.....

Adopted at the Stated Meeting of ..... 10 .....

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia, .....

S. & A. Case No. ....

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....  
..... reports as follows:

.....

In consideration of the {discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... the Institute awards the .....

.....

to ..... of .....

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned .....

*Chairman of the Committee on Science and the Arts.*



income from securities owned, and attention is being given to the creation of an organization suitable for the proper conduct of the work.

The report of the Committee on Instruction, Mr. Paul, Chairman, covers the ninety-eighth year of the School's existence. Two hundred and ninety students were enrolled, 183 less than the unusually large enrollment of the previous year. The Committee records its belief that the cause of the relatively small number of students registering during the year was the industrial depression in Philadelphia. The most marked reduction in the number of students was in the course in Naval Architecture. Other than the fact that we had a reduced enrollment, the School year can be regarded as highly successful from the point of view of the student and of the Institute.

The report of the Committee on Science and the Arts, Dr. Barnes, Chairman, covers its activities during its eighty-eighth year of continuous existence. The Committee's work during the year was little different from that of former years. The Sub-committee on Preliminary Examination considered fifty-six subjects, of which eighteen were recommended for investigation. Fifteen awards were made.

The Committee on Election and Resignation of Members, Mr. Lesley, Chairman, reports the election during the year of 44 members, the resignation of 37, the death of 23, and that 19 were dropped from the rolls for non-payment of dues. The net result is a loss in membership of 35. The Institute has now 1351 members. To comment on this loss in membership and in general on the small membership of the Institute would be only to repeat what has been said in past years, which may be briefly expressed by saying that the failure to attract a larger number of people to membership in an institution so venerable, honorable and useful is inexplicable, though various theories have from time to time been advanced in explanation.

Notable among the members of the Institute whose deaths we have sadly to record were Alfred W. Gibbs, a member of the Board of Managers from 1915 to 1922, and Coleman Sellers, Jr., for sixteen years Manager or Vice-President of the Institute.

Mr. Gibbs brought to the work of the Institute the fruit of many years' engineering experience and the will to devote that experience to the advancement of the mechanic arts through the medium of The Franklin Institute. His contributions to science were notable; his personality as well as his unfailing good sense made him an agreeable associate and a wise counsellor. He is greatly missed.

Coleman Sellers, Jr., by tradition and through inheritance was deeply interested in the work of the Institute. Turning to the YEAR BOOK we find that Mr. Sellers and his forebears have occupied the positions of Manager, Vice-President and President of The Franklin Institute for a total of approximately eighty years,—four-fifths of the Institute's life. Through three generations the Sellers' family have been prominent in the work of the Institute. Those of us who knew Coleman Sellers, Jr., and were witnesses of the ability and good-will brought by him to the service of science can judge what a profound and beneficial influence must have been



\$5,500.00 per year, are inadequate for the useful work that the Library Committee might accomplish in the purchase of books and the binding of volumes and pamphlets. For the present we must content ourselves with an annual expenditure approximating the above amount. As in previous years, we have to record that while our library attendance is small, due in part to the location of our building, it is to be noted that a large proportion of the people who come to the library come to consult many books and often spend days in such consultation.

Such, in brief, is the history of the Institute's activities during the year ending September 30, last. In some respects the record is unique. Notable among its features is the precedent established by the visit of Dr. Aston, above referred to. Your Board confidently anticipates that the precedent so brilliantly established will be maintained and that in the future from year to year we will be able to present to the scientists of America, courses of lectures upon scientific matters of interest by the leading scientists of the world. We anticipate that Prof. J. J. Thomson will visit the Institute the coming spring for the delivery of a series of lectures upon "The Electron in Chemistry." We are enabled to arrange this through the generosity of friends in the electrical industry who give this additional evidence of their intelligent interest in scientific matters and in The Franklin Institute. The success of the Institute in carrying out its plans in this respect, bringing to the Institute some of the most inspiring personalities of the world of science, must result in a notable stimulation of the scientific life of America.

Members of The Franklin Institute: Our institution is about to enter on the last year of its first century of life. Through one hundred years, unaided by National, State or municipal support, the Institute has given efficient service in the promotion of physical science—in time of peace knowing no national boundaries, its only recognized frontier being the advanced line of scientific endeavor—in time of war bending every energy to the aid of the nation in arms. This is the example set for us by four generations of men. It becomes us in these latter months of the Institute's first century of existence to resolve to so continue its work during the fraction of its life under our influence that men in the expiring hours of other centuries, seeing our accomplishment in perspective, shall judge us to have been not unworthy custodians of the life and traditions of The Franklin Institute. In our time there must be no break in the line of honorable tradition.

Membership in our institution has its responsibilities as well as its privileges. A part of your responsibility as members is to make sure that the men you entrust with official position are men of such capacity and good intent as insures the maintaining of our century old standards. Not otherwise than by recognizing and meeting this responsibility can you justify your membership in this venerable and honorable institution. The Franklin Institute is worthy of the best. It is for you to see that it has the best. As of today its destinies are in your hands.

Respectfully submitted,

WALTON CLARK,  
*President.*

PHILADELPHIA, January 17, 1923.



The contents of the library on September 30, 1922 were:

Volumes, bound and unbound .....	77,364
Pamphlets .....	18,611
Maps and Charts .....	2,292
Photographs .....	1,349

*Binding:*

During the year the following work was done by the binders:

Recent volumes of periodicals bound .....	319
1134 pamphlets bound .....	79
Recent volumes of foreign chemical periodicals bound and charged to the Chemical Periodical Binding Fund	33
Volumes charged to the Morris Fund .....	36
Old volumes, bound and rebound .....	57
	<hr/>
	524

*Magazines and Other Periodical Publications:*

6550 copies of the JOURNAL were used for exchange purposes.

Twenty-seven exchanges were added to the mailing list and one hundred and fifty-four were discontinued.

The total number of exchanges on September 30th was 459. The subscriptions totaled 172 and the number of gift subscriptions was 74, making the total number of periodical publications received, 705.

*Evening Hours:*

The library was open on twenty-eight meeting nights until ten o'clock, with a total attendance after six o'clock of 47 members.

Respectfully submitted,

CLARENCE A. HALL,  
*Chairman.*

PHILADELPHIA, January 10, 1923.

## REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

*To the President and Members of The Franklin Institute:*

The following models, apparatus and specimens have been added to the Institute's collection since the date of the last report:

Working model done to scale of the original Van Depocle tram-car, one of the earliest electrical lines to run in New England in the vicinity of Ansonia and Derby. It was capable of carrying twenty-five tons of freight. Presented by Mr. L. S. Storrs, President, The Connecticut Company, New Haven, Connecticut. A full description of this model appears in the Proceedings of the Stated Meeting of the Institute held November 16, 1921, (J. F. I., Vol. 192, page 819).

The first blanket of camels wool taken from the first loom erected in the





to May inclusive, at the hour of eight o'clock, with the exception of that of May 17 which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers with titles and synopses of their communications:

October 19, 1921: Ralph Modjeski, D. Eng., Chief Engineer, Delaware River Bridge Joint Commission, Philadelphia, Pennsylvania, member of the Institute presented a paper on "The Delaware River Bridge between Philadelphia and Camden." The speaker gave an account of the comparative study and considerations which led to the adoption of the suspension type of bridge and described the salient features and characteristics of the design. The subject was illustrated by lantern slides from the engineers' drawings and views of the bridge as it will appear when completed. The paper was printed in full in the January, 1922 issue of the JOURNAL.

At this meeting the Elliott Cresson Medal was presented to Dr. Byron E. Eldred of New York City for his invention of "Low Expansion Leading-in Wire for Incandescent Electric Lamps."

The Howard N. Potts Medal was presented to Mr. Alfred O. Tate, of Cranston, Rhode Island, for his process of water-proofing fabrics.

November 16, 1921: Heber D. Curtis, Ph.D., Director of the Allegheny Observatory, Pittsburgh, Pennsylvania, presented a paper on "The Spiral Nebulae and their Interpretation." The speaker pointed out that of all known classes of celestial objects, the spirals are perhaps the most difficult to fit into any coherent scheme of stellar evolution, either as a point of origin or as an evolutionary product. In form, in distribution, and in space velocity, they stand apart from all other objects observed in the Milky Way. Much modern observational evidence supports the belief that these beautiful objects are separate galaxies of stars, or "island universes," comparable with our own galaxy in size and in number of component suns. Evidence for and against the island universe theory of the spirals was presented. The subject was illustrated by lantern slides.

At this meeting Mr. L. S. Storrs presented to the Institute a beautifully constructed working model, done to scale, of the original Van Depoele motor.

The Edward Longstreth Medal was presented to His Excellency, James Hartness, Governor of Vermont, the inventor of the Hartness Screw Thread Comparator.

The Edward Longstreth Medal was also presented to Mr. Thomas Willing Hicks for his "Once-over" Tiller.

December 21, 1921: P. H. Bates, A.B., B.S., Chief, Structural and Miscellaneous Materials Division, Bureau of Standards, Washington, District of Columbia, presented a paper on "The Application of the Fundamental Knowledge of Portland Cement to Its Manufacture and Use."

The results of various attempts to determine the mineral constituents of Portland cement, culminating in the successful attempt of Rankin, were reviewed. The work of the Bureau of Standards in determining the physical properties of the different constituents was described. The relative amounts of these occurring in cement of normal manufacture, and the possibility and



# **PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS**

**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.**

## **REPORT OF THE PRESIDENT**

**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.**

*To the Members of The Franklin Institute:*

Your Board of Managers has instructed me to report to you on the affairs of the Institute for the Institute year ending September 30, 1922, as follows:

The Managers hope that reading this report and the reports of the several committees of the Board and of the Institute, as they will appear in the 1923 YEAR BOOK, will lead you to the conclusion that the work of the Institute was carried on through the year—as they believe—with results favorably comparable with those of previous years.

Following our established order, the Managers make such brief comment on these reports as seems suitable.

The Committee on Museum, Mr. Outerbridge, Chairman, reports the addition to the Museum of certain models and apparatus of interest, notable among them a working model of the original Van Depoele electric tram car, donated by Mr. L. S. Storrs, and a valuable set of scientific instruments once owned by the late George R. Henderson and donated by his widow. Our facilities for exhibiting our models, of which we have many of great scientific and historic interest, have not improved, and will not improve until we are able to store and properly display them in another building erected in whole or in part for the purpose. The provision of such a building is a part of our plans for the future, as more particularly discussed in our report for the Institute year ending September 30, 1921.

The Committee on Publication, Dr. Rosengarten, Chairman, reports the completion of the one-hundred and ninety-fourth volume of the JOURNAL. The Committee refers briefly to the contents of the JOURNAL for the current year and to the YEAR BOOK. The Committee reports that the demand for the work on the "Physics of the Air" by Dr. W. J. Humphreys, continues. Twelve hundred and fifty-four volumes have been sold since the work was issued less than two years ago. The evidence continues that the book is of great value to meteorologists and aviators and that The Franklin Institute has been more than justified in undertaking its publication.

The Committee on Exhibitions, Mr. Benjamin Franklin, Chairman, reports again on the contemporary status of the Sesqui-Centennial Exhibition in so far as it affects The Franklin Institute.

The report of the Committee on Sectional Arrangements, Dr. Keller, Chairman, records with some detail the lectures—nineteen in number—



income from securities owned, and attention is being given to the creation of an organization suitable for the proper conduct of the work.

The report of the Committee on Instruction, Mr. Paul, Chairman, covers the ninety-eighth year of the School's existence. Two hundred and ninety students were enrolled, 183 less than the unusually large enrollment of the previous year. The Committee records its belief that the cause of the relatively small number of students registering during the year was the industrial depression in Philadelphia. The most marked reduction in the number of students was in the course in Naval Architecture. Other than the fact that we had a reduced enrollment, the School year can be regarded as highly successful from the point of view of the student and of the Institute.

The report of the Committee on Science and the Arts, Dr. Barnes, Chairman, covers its activities during its eighty-eighth year of continuous existence. The Committee's work during the year was little different from that of former years. The Sub-committee on Preliminary Examination considered fifty-six subjects, of which eighteen were recommended for investigation. Fifteen awards were made.

The Committee on Election and Resignation of Members, Mr. Lesley, Chairman, reports the election during the year of 44 members, the resignation of 37, the death of 23, and that 19 were dropped from the rolls for non-payment of dues. The net result is a loss in membership of 35. The Institute has now 1351 members. To comment on this loss in membership and in general on the small membership of the Institute would be only to repeat what has been said in past years, which may be briefly expressed by saying that the failure to attract a larger number of people to membership in an institution so venerable, honorable and useful is inexplicable, though various theories have from time to time been advanced in explanation.

Notable among the members of the Institute whose deaths we have sadly to record were Alfred W. Gibbs, a member of the Board of Managers from 1915 to 1922, and Coleman Sellers, Jr., for sixteen years Manager or Vice-President of the Institute.

Mr. Gibbs brought to the work of the Institute the fruit of many years' engineering experience and the will to devote that experience to the advancement of the mechanic arts through the medium of The Franklin Institute. His contributions to science were notable; his personality as well as his unfailing good sense made him an agreeable associate and a wise counsellor. He is greatly missed.

Coleman Sellers, Jr., by tradition and through inheritance was deeply interested in the work of the Institute. Turning to the YEAR BOOK we find that Mr. Sellers and his forebears have occupied the positions of Manager, Vice-President and President of The Franklin Institute for a total of approximately eighty years,—four-fifths of the Institute's life. Through three generations the Sellers' family have been prominent in the work of the Institute. Those of us who knew Coleman Sellers, Jr., and were witnesses of the ability and good-will brought by him to the service of science can judge what a profound and beneficial influence must have been



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Notable among the members of the Institute whose deaths we have sadly to record were Alfred W. Gibbs, a member of the Board of Managers from 1915 to 1922, and Coleman Sellers, Jr., for sixteen years Manager or Vice-President of the Institute.

Mr. Gibbs brought to the work of the Institute the fruit of many years' engineering experience and the will to devote that experience to the advancement of the mechanic arts through the medium of The Franklin Institute. His contributions to science were notable; his personality as well as his unfailing good sense made him an agreeable associate and a wise counsellor. He is greatly missed.

Coleman Sellers, Jr., by tradition and through inheritance was deeply interested in the work of the Institute. Turning to the YEAR BOOK we find that Mr. Sellers and his forebears have occupied the positions of Manager, Vice-President and President of The Franklin Institute for a total of approximately eighty years,—four-fifths of the Institute's life. Through three generations the Sellers' family have been prominent in the work of the Institute. Those of us who knew Coleman Sellers, Jr., and were witnesses of the ability and good-will brought by him to the service of science can judge what a profound and beneficial influence must have been





\$5,500.00 per year, are inadequate for the useful work that the Library Committee might accomplish in the purchase of books and the binding of volumes and pamphlets. For the present we must content ourselves with an annual expenditure approximating the above amount. As in previous years, we have to record that while our library attendance is small, due in part to the location of our building, it is to be noted that a large proportion of the people who come to the library come to consult many books and often spend days in such consultation.

Such, in brief, is the history of the Institute's activities during the year ending September 30, last. In some respects the record is unique. Notable among its features is the precedent established by the visit of Dr. Aston, above referred to. Your Board confidently anticipates that the precedent so brilliantly established will be maintained and that in the future from year to year we will be able to present to the scientists of America, courses of lectures upon scientific matters of interest by the leading scientists of the world. We anticipate that Prof. J. J. Thomson will visit the Institute the coming spring for the delivery of a series of lectures upon "The Electron in Chemistry." We are enabled to arrange this through the generosity of friends in the electrical industry who give this additional evidence of their intelligent interest in scientific matters and in The Franklin Institute. The success of the Institute in carrying out its plans in this respect, bringing to the Institute some of the most inspiring personalities of the world of science, must result in a notable stimulation of the scientific life of America.

Members of The Franklin Institute: Our institution is about to enter on the last year of its first century of life. Through one hundred years, unaided by National, State or municipal support, the Institute has given efficient service in the promotion of physical science—in time of peace knowing no national boundaries, its only recognized frontier being the advanced line of scientific endeavor—in time of war bending every energy to the aid of the nation in arms. This is the example set for us by four generations of men. It becomes us in these latter months of the Institute's first century of existence to resolve to so continue its work during the fraction of its life under our influence that men in the expiring hours of other centuries, seeing our accomplishment in perspective, shall judge us to have been not unworthy custodians of the life and traditions of The Franklin Institute. In our time there must be no break in the line of honorable tradition.

Membership in our institution has its responsibilities as well as its privileges. A part of your responsibility as members is to make sure that the men you entrust with official position are men of such capacity and good intent as insures the maintaining of our century old standards. Not otherwise than by recognizing and meeting this responsibility can you justify your membership in this venerable and honorable institution. The Franklin Institute is worthy of the best. It is for you to see that it has the best. As of today its destinies are in your hands.

Respectfully submitted,

WALTON CLARK,

*President.*

PHILADELPHIA, January 17, 1923.



The contents of the library on September 30, 1922 were :

Volumes, bound and unbound .....	77,364
Pamphlets .....	18,611
Maps and Charts .....	2,292
Photographs .....	1,349

*Binding:*

During the year the following work was done by the binders :

Recent volumes of periodicals bound .....	319
1134 pamphlets bound .....	79
Recent volumes of foreign chemical periodicals bound and charged to the Chemical Periodical Binding Fund	33
Volumes charged to the Morris Fund .....	36
Old volumes, bound and rebound .....	57
	<hr/>
	524

*Magazines and Other Periodical Publications:*

6550 copies of the JOURNAL were used for exchange purposes.

Twenty-seven exchanges were added to the mailing list and one hundred and fifty-four were discontinued.

The total number of exchanges on September 30th was 459. The subscriptions totaled 172 and the number of gift subscriptions was 74, making the total number of periodical publications received, 705.

*Evening Hours:*

The library was open on twenty-eight meeting nights until ten o'clock, with a total attendance after six o'clock of 47 members.

Respectfully submitted,

CLARENCE A. HALL,  
*Chairman.*

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

*To the President and Members of The Franklin Institute:*

The following models, apparatus and specimens have been added to the Institute's collection since the date of the last report:

Working model done to scale of the original Van Depoele tram-car, one of the earliest electrical lines to run in New England in the vicinity of Ansonia and Derby. It was capable of carrying twenty-five tons of freight. Presented by Mr. L. S. Storrs, President, The Connecticut Company, New Haven, Connecticut. A full description of this model appears in the Proceedings of the Stated Meeting of the Institute held November 16, 1921, (J. F. I., Vol. 192, page 819).

The first blanket of camels wool taken from the first loom erected in the



to May inclusive, at the hour of eight o'clock, with the exception of that of May 17 which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers with titles and synopses of their communications:

October 19, 1921: Ralph Modjeski, D. Eng., Chief Engineer, Delaware River Bridge Joint Commission, Philadelphia, Pennsylvania, member of the Institute presented a paper on "The Delaware River Bridge between Philadelphia and Camden." The speaker gave an account of the comparative study and considerations which led to the adoption of the suspension type of bridge and described the salient features and characteristics of the design. The subject was illustrated by lantern slides from the engineers' drawings and views of the bridge as it will appear when completed. The paper was printed in full in the January, 1922 issue of the JOURNAL.

At this meeting the Elliott Cresson Medal was presented to Dr. Byron E. Eldred of New York City for his invention of "Low Expansion Leading-in Wire for Incandescent Electric Lamps."

The Howard N. Potts Medal was presented to Mr. Alfred O. Tate, of Cranston, Rhode Island, for his process of water-proofing fabrics.

November 16, 1921: Heber D. Curtis, Ph.D., Director of the Allegheny Observatory, Pittsburgh, Pennsylvania, presented a paper on "The Spiral Nebulae and their Interpretation." The speaker pointed out that of all known classes of celestial objects, the spirals are perhaps the most difficult to fit into any coherent scheme of stellar evolution, either as a point of origin or as an evolutionary product. In form, in distribution, and in space velocity, they stand apart from all other objects observed in the Milky Way. Much modern observational evidence supports the belief that these beautiful objects are separate galaxies of stars, or "island universes," comparable with our own galaxy in size and in number of component suns. Evidence for and against the island universe theory of the spirals was presented. The subject was illustrated by lantern slides.

At this meeting Mr. L. S. Storrs presented to the Institute a beautifully constructed working model, done to scale, of the original Van Depoele motor.

The Edward Longstreth Medal was presented to His Excellency, James Hartness, Governor of Vermont, the inventor of the Hartness Screw Thread Comparator.

The Edward Longstreth Medal was also presented to Mr. Thomas Willing Hicks for his "Once-over" Tiller.

December 21, 1921: P. H. Bates, A.B., B.S., Chief, Structural and Miscellaneous Materials Division, Bureau of Standards, Washington, District of Columbia, presented a paper on "The Application of the Fundamental Knowledge of Portland Cement to Its Manufacture and Use."

The results of various attempts to determine the mineral constituents of Portland cement, culminating in the successful attempt of Rankin, were reviewed. The work of the Bureau of Standards in determining the physical properties of the different constituents was described. The relative amounts of these occurring in cement of normal manufacture, and the possibility and



However, if the nucleus is broken up, no known experimental means suffice to put it together again; so the atom is said to disintegrate only when the nucleus is broken apart.

The lightest of all atoms, that of hydrogen, consists of one hydrogen nucleus with one positive charge, or what will be termed a positive electron which carries practically all of the mass of the atom together with a planetary system consisting of one negative electron. All of the heavier or complex atoms seem to have nuclei which are built up from a number of positive electrons equal to the atomic weight, together with about half as many negative electrons which serve to bind them together.

The conditions under which an atom nucleus is stable were discussed. The principal stability conditions are very simple. The most stable nuclei contain an even number of both negative and positive electrons, the more important condition being that the number of negative electrons shall be even. Light atoms are in general more stable than heavy ones, though there are more types of heavy than of light atoms.

One of the most important of the stability conditions is that as the positive charge on the nucleus becomes larger the ratio of negative to positive charges in the nucleus must also become larger. That is, as the net positiveness of the nucleus increases the relative negativeness must also increase.

If the complete history of the building of atoms could be unfolded, it would undoubtedly be seen to be one of fundamental importance in determining the present condition of the stars, and also of the surface of the earth and the organisms which dwell upon it.

That elements may be split apart into isotopes has been found recently. The first isotopes separated, those of chlorine, were exhibited. The subject was illustrated by lantern slides, models and specimens. The publication of this paper was begun in the August issue of the JOURNAL and will appear in several succeeding issues.

At this meeting the Edward Longstreth Medal was awarded to Mr. Samuel T. Freas, of Trenton, New Jersey, for his "Interlocking" Tooth Saw.

The Edward Longstreth Medal was also presented to Mr. Joseph F. Keller, of Brooklyn, New York, for his Automatic Die Cutting Machine.

May 17, 1922: The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership were presented to Mr. R. L. Craigie, First Secretary of the British Embassy, for transmission to Sir Joseph John Thomson, Master of Trinity College, Cambridge, England, whose paper on "An Electron Theory of Solids" was read by Dr. Joseph S. Ames of the Johns Hopkins University, Baltimore, Maryland.

The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership were presented to Dr. Ralph Modjeski of New York City, who read a paper on "Bridges—Old and New."

A portrait of Dr. Walton Clark, painted in oil, by Mr. Lazar Raditz, was presented to the Institute by Mr. Nathan Hayward, member of the Board of Managers, on behalf of the Officers, Board of Trustees, and Board of Managers of the Institute.





Mr. H. H. Fox, of the Germantown High School Faculty, Mathematics.

Mr. W. Earl Neilson, Student in the Wharton School, University of Pennsylvania, Mathematics.

Mr. Bartram A. Owen, of the University of Pennsylvania Faculty, Applied Mechanics and Strength of Materials, and Structural Design.

Mr. B. W. Taylor, of the University of Pennsylvania Faculty, Machine Design.

Mr. B. B. Wood, William Cramp and Sons' Ship and Engine Building Company, Naval Architecture.

Mr. R. E. Brown, The New York Shipbuilding Corporation, Naval Architecture.

Mr. Wm. S. Owen, The New York Shipbuilding Corporation, Naval Architecture.

Mr. James G. Morgan, The New York Shipbuilding Corporation, Naval Architecture.

During the year, students of the School and members of the Alumni Association visited the following places of engineering interest:

The Otis Elevator Company, Philadelphia, Pennsylvania.

Morris Wheeler and Company, Philadelphia, Pennsylvania.

Sun Shipbuilding Company, Chester, Pennsylvania.

League Island Navy Yard, Philadelphia, Pennsylvania.

David Lupton's Sons Company, Philadelphia, Pennsylvania.

Sherritt and Stoer Company, Philadelphia, Pennsylvania.

DeLong Hook and Eye Company, Philadelphia, Pennsylvania.

The attendance at these visits was good and much interest was shown by those present. The representatives of the various establishments received the students most courteously and spared no effort to make the visits both interesting and instructive.

The graduating exercises were held in the Hall of the Institute on Friday evening, April 21, 1922. Dr. Walton Clark, President of the Institute, presided. The speaker of the evening was Rev. John H. Chapman. The Alumni Association was represented by Mr. James G. Morgan. Sixty-one students were graduated; ten in Mechanical Drawing, seven in Architectural Drawing, one in Freehand Drawing, twenty in Mathematics, twelve in Mechanics, and eleven in Naval Architecture.

On rising to confer the certificates, Dr. Clark made the following remarks to the graduates:

"Young Men, Members of the Class of 1922:

"We congratulate ourselves that The Franklin Institute has had a part in aiding you in your effort to achieve, through education, positions of greater usefulness to yourself and to others. We of the Institute realize that ours has been the smaller—though still a very important—part in the education of your hands and brains to greater skill, and as we hope, in the education of your hearts, to possibilities of greater happiness. We have offered you opportunity for study under skilled direction. You



During the summer the School Calendar for the session of 1922-23 was published, 3000 copies of which and 1000 posters were distributed in such a way as seemed likely to reach the greatest number of possible students.

A schedule of visits to engineering establishments, including the Belmont Pumping Station and Filtering Plant of Philadelphia, was arranged. Visits to ice plants and ice cream manufacturing establishments are also contemplated.

Respectfully submitted,

LAWRENCE T. PAUL,  
*Chairman.*

PHILADELPHIA, January 10, 1923

REPORT OF THE COMMITTEE ON ELECTION AND  
RESIGNATION OF MEMBERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

*To the Board of Managers of The Franklin Institute:*

During the fiscal year ending September 30th, 1922 forty-four new members were enrolled in all classes of membership; resignations were received and accepted from thirty-seven members; and deaths of twenty-three members were recorded.

The detail as to elections, resignations, and deaths for the three years ending September 30, 1922 is as follows:

ELECTIONS:

	1919-20	1920-21	1921-22
Resident Members .....	32	30	24
Non-Resident Members .....	19	35	12
Associate Members .....	11	5	3
Honorary Members .....	2	3	3
Corresponding Members .....	3	0	0
Life Members .....	0	2	2
Second Class Stock .....	0	0	0
	—	—	—
	67	75	44

RESIGNATIONS:

Resident Members .....	10	9	17
Non-Resident Members .....	14	14	20
Associate Members .....	0	1	0
Second Class Stock .....	0	0	0
	—	—	—
	33	24	37



## REPORT OF THE COMMITTEE ON STOCKS AND FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Board of Managers of The Franklin Institute:

The Committee presents the following financial statement:

### PROPERTY AND FUNDS

Building and Land, 13-17 South Seventh Street....	\$60,000.00		
Library .....	100,000.00		\$160,000.00
		<i>Unexpended</i>	
	<i>Principal</i>	<i>Income</i>	
Funds held by Board of Trustees....	\$629,713.77	\$1,864.35	
Funds held by Board of Managers...	157.23		
Franklin Institute Building Fund...	538,782.03		
Elliott Cresson Medal Fund.....	3,000.00	796.56	
Franklin Fund and Building Committee	25,288.94		
	<hr/>	<hr/>	
Total Funds .....	\$1,196,941.97	\$2,660.91	\$1,199,602.88
			<hr/>
Grand Total .....			\$1,359,602.88

### LIABILITIES

Certificates of Stock .....	\$29,040.00
Bills Payable .....	20,000.00
Vouchers Payable .....	3,579.88
Unearned Income .....	8,840.60
	<hr/>
	\$55,460.48

INCOME AND EXPENSES APPLICABLE TO YEAR ENDED SEPTEMBER 30, 1922.

### Income:

Dues—Resident .....	\$7,447.50	
Nonresident .....	2,945.00	
Second Class Stock .....	288.00	
Associate .....	120.00	\$10,800.50
	<hr/>	
Initiation Fees .....		90.00
Harriet Blanchard Legacy .....		1,997.22
H. Belfield Memorial Fund .....		268.82
James H. Cresson Memorial Fund .....		2,267.92
General Endowment Fund .....		20,389.36
John H. Wahl Fund .....		4,473.34
Lewis S. Ware Library Fund .....		600.00
Estate of John Turner .....		148.42



Interest and Discount .....	239.08
Badges and Certificates .....	33.00
	<hr/>
Total .....	\$64,523.67
	<hr/>
Deficit .....	\$10,016.93

There was an addition of \$28,586.08 during the year in the principal of funds held by the Institute. This consisted, mainly, of \$15,790.50 added to The Franklin Institute Building Fund by accretions of income, and of \$10,000 added to the fund in the possession of the Franklin Fund and Building Committee by writing on as an asset of that Committee, the \$10,000 note held by it for money loaned the Institute and always carried as a liability of the Institute but never hitherto as an asset of the Committee, and therefore of the Institute.

Respectfully submitted,

WALTON FORSTALL,  
*Chairman.*

PHILADELPHIA, January 10, 1923.

## REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922

*To the Board of Managers of The Franklin Institute:*

The one hundred and ninety-fourth volume of the JOURNAL will be completed when this report is presented. This and the preceding volume will include a record of the activities of the Institute during the ninety-eighth year of its existence.

The papers published in the JOURNAL have consisted in large part of the lectures delivered before the Institute and its sections with a number of original communications from specialists of acknowledged authority in their respective lines of activity.

The notices of the results of recent research, furnished to the JOURNAL by the Bureau of Standards and the other leading research laboratories throughout the country, have appeared from month to month in its pages.

The eleventh volume of the Year Book, issued during the current year, contains the report of the President of the Institute and of its various standing committees with such other information as may be of interest to our membership. The practice of distributing this volume among the scientific associations and technical societies at home and abroad, as a means of increased publicity for the Institute, is being continued.

The demand for the work on the "Physics of the Air" by Dr. W. J. Humphreys continues. Twelve hundred fifty-four copies have been sold since the work was first issued less than two years ago. The very flattering press notices which have appeared indicate that the book is one which is of extreme value to meteorologists and aviators.





lems, which arise in connection with the various types, were mentioned; and the mode of solution was outlined. An account was given of wind-tunnel experiments and actual flying tests. The lecture was illustrated with lantern slides. The paper appeared in full in the January, 1922 issue of the JOURNAL.

October 13, 1921: William Duane, A.M., Ph.D., Professor of Biophysics in Harvard University, Cambridge, Massachusetts presented a paper on "X-ray Spectra and Crystal Structure." The methods for the measurement of x-ray spectra with precision were described. The general character of, and the experimental relations between, continuous, line and x-ray absorption spectra were discussed. An account was given of the evidence obtained through the x-rays concerning the structure of crystals and of atoms, the mechanism of radiation, the quantum law, and the theory of relativity. In conclusion, stress was placed on the importance of spectrum analysis in medical applications of the x-rays. The lecture was illustrated with lantern slides.

October 27, 1921: Henry Leffmann, A.M., M.D., Ph.D., D.D.S., Lecturer on Research in the Philadelphia College of Pharmacy and Science, presented a communication on "The Application of the Microscope to Research." An account was given of the use of color screens, polarized light, photography with ordinary and special plates, and the staining of minute objects. The lecture illustrated with lantern slides was printed in full in the January, 1922 issue of the JOURNAL.

November 10, 1921: Albert W. Hull, Ph.D., of the Research Laboratory of the General Electric Company, Schenectady, New York, read a paper on "The Crystal Structures of the Common Elements." A description was given of the apparatus for the analysis of crystals by means of the x-rays. The available data on this subject were reviewed and summarized. The lecture was illustrated with lantern slides. The paper was printed in the February, 1922 issue of the JOURNAL.

December 1, 1921: Eugene T. Allen, Ph.D., Research Chemist, Geophysical Laboratory of the Carnegie Institution of Washington, District of Columbia presented a communication entitled, "Chemical Aspects of Volcanism," in which the origin of volcanic gases and the factors influencing their chemical composition were discussed. The subject was illustrated by lantern slides. The paper was printed in the January, 1922 issue of the JOURNAL.

December 8, 1921: E. A. Eckhardt, Ph.D., Chief of the Sound Section, Bureau of Standards, Washington, District of Columbia, read a paper on "The Precise Measurement of Small Time Intervals." An account was given of the recent developments of the methods of and facilities for measuring small time intervals. The applicability of apparatus and methods to both scientific and industrial purposes was discussed. The applications to the measurement of linear and angular velocities and accelerations, vibration frequencies, etc., were described. The subject was illustrated by lantern slides.



tion of ammonia and other gases; hydrogenation processes and the hardening of liquid fats; processes of hydrolysis, including the production of soaps and alcohol; applications in the fine chemical industry and in electrochemistry. The subject was illustrated by exhibits, experiments and lantern slides. This paper was printed in the July, 1922 issue of the JOURNAL.

March 2, 1922: Colonel E. Lester Jones, A.M., Director of the United States Coast and Geodetic Survey and Commissioner, International Boundary. United States-Alaska and Canada, read a paper on "Surveying from the Air." The standard surveying methods of the United States Coast and Geodetic Survey were described; and the history of aerial surveying was outlined. An account was given of the aerial surveys of Atlantic City, the Coast of New Jersey and the delta of the Mississippi River. The subject was illustrated with lantern slides. This paper was printed in the April, 1922 issue of the JOURNAL.

March 23, 1922: R. B. Moore, Sc.D., Chief Chemist, Bureau of Mines, United States Department of the Interior, Washington, District of Columbia, presented a paper on "Low Temperature Research and the Cryogenic Laboratory of the Bureau of Mines." A resumé was given of the history of the liquefaction of gases with special reference to air, hydrogen, and helium. The application of low temperature work to physical constants and to the knowledge of the constitution of matter was described. The lecture was illustrated by lantern slides and experiments.

April 6, 1922: E. W. Washburn, Ph.D., Department of Ceramics, University of Illinois, Urbana, Illinois, read a communication on "Physical Chemistry and Ceramics." The application of the methods of physical chemistry to the solution of various problems in the field of ceramics was described. The subject was illustrated by lantern slides. The paper was printed in the June, 1922 issue of the JOURNAL.

April 13, 1922: K. T. Compton, Ph.D., Professor of Physics in Princeton University, Princeton, New Jersey, presented a communication on "The Physics of the Three-Electrode Bulb." The Edison and thermionic effects were demonstrated; the properties of thermionic currents, the theories of thermionic emission, and the characteristics of evacuated and gas-filled bulbs were described. The paper was illustrated by means of lantern slides and experiments.

Electrical Section: Three Meetings.

November 3, 1921: Fred H. Albee, A.M., Sc.D., M.D., of New York City, New York, read a paper on "The Use of Electric Machine Tools in Bone Surgery." The evolution of surgical instruments for the cutting of bone was traced; and an account was given of the construction and use of the automatic machine tools devised by Dr. Albee for use in bone surgery. The tools were exhibited and lantern slides and moving pictures were used to illustrate the subject.

February 2, 1922: L. W. Austin, Ph.D., D.Sc., Head, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, District of Columbia, presented a paper on "Recent Development in Radio Communication." Atten-



one of many evident causes, and as a consequence disastrous end-on collisions not infrequently occur.

To overcome this defect in the present system of railroad operation many kinds of "automatic stops" and "automatic train controls" have been proposed, designed to protect the train in the event of failure of the engineer, but a satisfactory solution of the problem, that is, one which while affording ample protection will at the same time leave the engineer under all normal conditions in control of his train is a difficult one.

The paper dealt with a specific development based upon the use of track magnets under control of the signal relay, to establish cab signals and to initiate the required braking, which system is being subjected to intensive tests on the New York Central Railroad. This system is based on the same track fundamentals as is the automatic signal system and can be used either independently of it, that is, with cab signals only, or in connection with the wayside signals to combine them and the braking system of the train. The paper was printed in the August, 1922 issue of the JOURNAL.

The attendance at these meetings totaled 1968.

Dr. F. W. Aston, F.R.S., Fellow of Trinity College, Cambridge, England, delivered a series of lectures on "Atomic Weights and Isotopes" in the lecture hall of the Institute on the afternoons of March 6th to 10th inclusive.

The first lecture was delivered on the afternoon of Monday, March 6th, at 3:30 o'clock. Mr. Coleman Sellers, Jr., Vice-president of the Institute, welcomed Dr. Aston, and Dr. Arthur W. Goodspeed, Professor of Physics, University of Pennsylvania, M.F.I., presided. The subject of this lecture was "The Atomic Nature of Matter" and the following is a brief synopsis:

The atomic structure of matter generally; ancient speculation. "Is matter infinitely divisible?" Views of Newton and the early chemists. Dalton's atomic theory. Size and number of atoms illustrated by repeated subdivisions of a cube of lead. Relative delicacy of methods for the detection of elements. Modern methods of detection of single atoms.

Dr. Augustus Trowbridge, Professor of Physics, Princeton University, M.F.I., presided at the second lecture on Tuesday, March 7th. Subject "Discharge of Electricity in Gases." Special attention was given the following:

Nature of low-pressure discharge. Crookes' dark space, its length at different pressures in various gases, variation with current intensity. Primary dark space. Distribution of potential in the Crookes' dark space. Failure of theories suggested. Cathode rays and positive rays.

Mr. W. H. Fulweiler, Chief Chemist, United Gas Improvement Company, Philadelphia, M.F.I., presided at the third lecture on Wednesday, March 8th. Subject, "Positive Rays and Their Analysis." Special attention was given to the following:

Sir J. J. Thomson's parabola method of analysis of positive rays. First proof of the approximate identity of weights of atoms of the same element. Abnormal chemical compounds. Triatomic hydrogen. Neon and its para-



## REPORT OF COMMITTEE ON ENDOWMENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

*To the Board of Managers of The Franklin Institute:*

Your Committee has been chiefly engaged during the year with the settlement of the Henry W. Bartol Estate and final settlements were made with Lucy Cheyney Farr and Katherine de Monclos, daughters of Mr. Bartol. Funds to the amount of \$300,000.00, \$150,000.00 for each of the daughters, were assigned out-right to them and turned over to their representatives. Trust funds in like amount, in which the daughters have only a life interest, were received and deposited with the Girard Trust Company as agent for The Franklin Institute. These trust funds will revert to the Institute at the death of these ladies.

In order that trust funds created under the Will of Henry W. Bartol, deceased, may be kept separate from the other funds of the Institute, securities and other assets which the Institute has or receives from time to time as beneficiary under the Will, are being designated in the full name of the Institute with the sub-title Bartol Research Foundation.

The French Estate of Mr. Bartol has not been settled and the value of the Institute's interest in it is not definitely known. The attorneys handling this case for the Institute have been requested to effect settlement as soon as possible.

The principal of funds other than the Bartol bequest, held by the Institute, was increased during the year in the amount of \$28,586.08. This consisted mainly of \$15,790.50 added to The Franklin Institute Building Fund by accretions of income, and of the \$10,000.00 added to the fund in the possession of The Franklin Fund and Building Committee by writing on as an asset of that Committee the \$10,000.00 note held by it, for money loaned the Institute and always carried as a liability of the Institute but never hitherto as an asset by the Committee, and therefore, of the Institute. No additions were made to the Institute's funds during the year through gift or bequest.

On February 28th, a check for \$1,997.22 was received from the Pennsylvania Company for Insurance on Lives and Granting Annuities, being the Institute's share in the final distribution of the Estate of Harriet Blanchard, deceased, and making a total of \$57,549.00 received from this Estate.

Respectfully submitted,

G. H. CLAMER,  
*Chairman.*

PHILADELPHIA, January 10, 1923.

## REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

*To the President and Members of The Franklin Institute:*

The year just closing was the eighty-eighth in which the Committee on Science and the Arts has rendered service to the Institute. During this





The attendance at the Stated Meetings of the Committee on Science and the Arts has been most satisfactory. The dinners preceding the meetings have been well attended and serve to make those who attend, better acquainted as well as to give an opportunity for the discussion of questions pertaining to the work of the Committee.

A detailed statement of the work of the Committee during the past year is appended.

Respectfully submitted,

JAMES BARNES,  
*Chairman.*

#### APPENDIX.

##### STATEMENT OF THE COMMITTEE'S OPERATION FOR THE

YEAR ENDING SEPTEMBER 30, 1922.

Cases pending October 1, 1921 .....	16
Applications during the year .....	11
Special Reports .....	5
	—
	32
Disposed of during the year .....	18
Leaving pending .....	14

##### AWARDS MADE

Franklin Medal Awards .....	2
Howard N. Potts Awards .....	3
Edward Longstreth Awards .....	5
Certificates of Merit Awards .....	5
	—
	15

##### AWARDS MADE DURING THE YEAR

###### THE FRANKLIN MEDAL

Dr. Ralph Modjeski, of New York City, New York, "in recognition of his signal achievements as a designer and builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

Professor J. J. Thomson, Master of Trinity College, Cambridge, England, "in recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

###### THE HOWARD N. POTTS MEDAL

E. G. Coker, University of London, England, for his Method of Determining Stress by Photo-Elastic Means.



Lord Balfour said that in honoring Sir Joseph Thomson the Franklin Institute had not merely conveyed a signal sense of their estimate of Sir Joseph's merits as an individual, but they had conferred an honor upon the country where he was born and where he had done all the great work that had given him the distinguished place he occupied without contest among the scientific celebrities of the world. He (Lord Balfour) was sorry to say he was old enough to remember the giants who rendered physics illustrious in this country in the second half of the nineteenth century. He knew Lord Kelvin well; he knew others of his great Cambridge contemporaries; and their fame was not likely to be shaken by any discoveries which their successors might be fortunate enough to make. Yet he thought he would be borne out by all those competent to speak when he said that the last decade of the last century and successive years of the twentieth century would always be remembered in the history of physical and mathematical science as some of the most fruitful and epoch making the world had ever known. (Cheers.)

Physical research had penetrated into regions never hitherto explored, and he well remembered that Lord Kelvin, who had himself done so much to prepare the new epoch, was nevertheless almost shocked by some of the theories which had now been accepted universally as representing the most recent advances in physical science. One of the greatest of pioneers in this greatest of scientific movements was Sir Joseph Thomson. (Cheers.) What he had done in physics, in electricity as a department of physics, in the structure of the atom, in all those investigations which were proving day by day more and more fruitful, which were opening up such astonishing and unimagined vistas into the truths of Nature, and the full importance of which only future generations would be able adequately to estimate—to all these great performances it would take far more time than they had at their disposal, and far more knowledge than he (Lord Balfour) pretended to possess, to do anything like justice.

Sir Joseph Thomson said there was something besides a personal element in the bestowal of that honor—there was a contribution to the brotherhood of science between America and Britain. (Cheers.) He valued especially the association of the medal with the name of Franklin. He knew nothing quite analogous to Franklin's achievement in scientific history, for he obtained his immortal position practically by six years' work. He did it by sheer force of intellect, and he came to it without any scientific training. He had to the end of his life no mathematics. In fact, he was afraid Franklin classed mathematics and classics as things which it was quite undesirable to retain in a general scheme of education. (Laughter.) The writing of Franklin's contemporaries seemed out of date today, but not so Franklin's, and the striking thing about all his scientific work was that he appeared to regard it as a mere episode in his career to which he paid little importance. To find a man who had done work of the highest rank in so many subjects as Franklin, they had to go back to Leonardo da Vinci.

Among those present were:—

Mr. H. Goold, representing the American Ambassador, Sir C. Sherington (President), Sir David Prain (Treasurer), Mr. W. B. Hardy (Secretary), Sir Aubrey Strahan and Professor A. Harden, representing the Royal Society, Dr. Elwell Hendricks, representing the Society of Chemical Industry of New York and the American Chemical Society, Professor T. H. Goodspeed, Berkeley, U. S. A., Professor W. G. McCallum, Baltimore, U. S. A., Professor R. F. Ruttan, Canadian Advisory Council, and the following members of the Advisory Council of the Department of Scientific and Industrial Research:—Sir William McCormick (chairman), Professor J. B. Farmer, Sir George Beilby, Sir R. Threlfall, Professor S. Young, Sir J. F. C. Snell, Professor J. F. Thorpe, Sir H. Miers, and Sir H. Frank Heath (Secretary).

# THE FRANKLIN INSTITUTE AWARDS

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OCTOBER, 1922 TO JUNE, 1923

## THE FRANKLIN MEDAL

TO

General G. Ferrié, Paris, France, "in recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization and directing of the communication service of the French Army during the World War."

Dr. Albert A. Michelson, "in recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."

## THE ELLIOTT CRESSON MEDAL

TO

Lee de Forest, Jersey City, New Jersey, for his inventions embodied in the Audion.

Raymond D. Johnson, New York City, N. Y., for his inventions embodied in the Johnson Hydraulic Valve.

Albert Kingsbury, Philadelphia, Pennsylvania, for his inventions embodied in the Kingsbury Thrust Bearing.

## THE HOWARD N. POTTS MEDAL

TO

Albert W. Hull, Schenectady, New York, for his paper entitled "The Crystal Structure of the Common Elements."

## THE EDWARD LONGSTRETH MEDAL

TO

Edward J. Brandt, Watertown, Wisconsin, for his inventions embodied in the Brandt Automatic Cashier.

Noiseless Typewriter Company, New York, for the inventions and improvements embodied in the Noiseless Typewriter.

A. H. Pfund, Baltimore, Maryland, for his inventions embodied in his Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.

Société Genevoise, Geneva, Switzerland, for the inventions embodied in the Universal Measuring Machine.

## THE CERTIFICATE OF MERIT

TO

Harry R. Maxon, Muncie, Indiana, for his inventions embodied in the Maxon Pre-Mix Burner.

P. Lecomte du Nouy, New York City, N. Y., for his inventions embodied in the Surface Tension Apparatus.



## YEAR BOOK OF

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"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

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DR. RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

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Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

SAUVER, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

SPELLIER, LOUIS H.

Time Telegraph.—1881.

SPRAGUE, F. J.

Multiple Unit System of Electric Traction.—1903.

SQUIER, MAJOR GEO. OWEN.

Multiplex Telephony.—1912.

STEINMETZ, C. P.

Application of Analytics to Electrical Engineering.—1913.

STRATTON, S. W.

Leading Work in Metrology.—1912.

TALBOT, B.

Open Hearth Steel Process.—1909.

TATHAM, W. P.

Printing Press.—1875.

TAYLOR, E. R.

Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.

TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.

Process of Treating Tool Steel.—1902.

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

U. S. GEOLOGICAL SURVEY.

Exhibit of Survey.—1900.

UNDERWOOD TYPEWRITER COMPANY.

Typewriter.—1909.

VAUCLAIN, S. M.

Compound Locomotive.—1891.

VERNAZ, ALEXIS.

Milling Files.—1909.

VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.

Spindle Support.—1891.

WALKUP, L.

Air Brush.—1886.

WATERHOUSE, A. G., AND FORBES, JOHN S.

Art of Automatically Heating and Sterilizing Fluids.—1901.

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901.

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

"Econometer."—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

## POTTS MEDAL AWARDS

1911-1923

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.





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PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.



SAUVER, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

SPELLIER, LOUIS H.

Time Telegraph.—1881.

SPRAGUE, F. J.

Multiple Unit System of Electric Traction.—1903.

SQUIER, MAJOR GEO. OWEN.

Multiplex Telephony.—1912.

STEINMETZ, C. P.

Application of Analytics to Electrical Engineering.—1913.

STRATTON, S. W.

Leading Work in Metrology.—1912.

TALBOT, B.

Open Hearth Steel Process.—1909.

TATHAM, W. P.

Printing Press.—1875.

TAYLOR, E. R.

Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.

TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.

Process of Treating Tool Steel.—1902.

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

U. S. GEOLOGICAL SURVEY.

Exhibit of Survey.—1900.

UNDERWOOD TYPEWRITER COMPANY.

Typewriter.—1909.

VAUCLAIN, S. M.

Compound Locomotive.—1891.

VERNAZ, ALEXIS.

Milling Files.—1909.

VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.

Spindle Support.—1891.

WALKUP, L.

Air Brush.—1886.

WATERHOUSE, A. G., AND FORBES, JOHN S.

Art of Automatically Heating and Sterilizing Fluids.—1901.

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901.

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

"Econometer."—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

## POTTS MEDAL AWARDS

1911-1923

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.



## LONGSTRETH MEDAL AWARDS

1890-1923

ARBE, C.

"Meteorology" (Paper).—1913.

ARBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.



DESHLER, CHARLES, AND McALLISTER, EDWARD J.

Portable Photometer.—1900.

DEVOR, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

EBERHARDT, HENRY F., AND ULRICH, F. L.

Radial Gang Cutter.—1904.

EDDISON, WILLIAM BARTON.

Jet Entraining Apparatus.—1921.

EDISON, THOMAS A., AND BROWN, HAROLD P.

Rail Bonds and Electrical Contacts.—1899.

EDWARDS, LEVI TALBOT.

Compound Air-Lift System.—1918.

ELLIS, CARLETON.

Paint and Varnish Remover.—1916.

EVE, A. S.

"Modern Views on the Construction of the Atom" (Paper).—1916.

FAY, C. N., SHOLES, Z. G., AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

FOULERT, W. I.

Time Stamp.—1906.

FORMER AND SCHWING MFG. COMPANY.

Graflex Cameras.—1905.

FORBES, J. S., AND ADAMS, W. G.

Stop Valve for Radiators.—1893.

FREAS, SAMUEL T.

"Interlocking" Tooth Saw.—1922.

FRECK, FRED

Electric Program Clock.—1890.

FULLER, G. W.

"Biochemical and Engineering Aspects of Sanitary Water Supply"  
(Paper).—1910.

GOLDMAN, HENRY.

Arithmachine.—1901.

GODFREY, CHARLES

Projection Lantern.—1895.

GOANNEY, J. H.

Stadia Rod.—1900.



IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnect.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH, F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLEY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

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KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.



LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MARSH, E. B.,

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MILEY, HENRY M., AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHROP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—  
1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-Violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY, W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1919.

- SCHMIDT, MAX, AND SIEBER, JOSEPH.  
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.  
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.  
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.  
“Organic Constituents in Soils” (Paper).—1912.
- SCRIPTURE, E. W.  
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.  
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.  
Super-Centrifuge.—1916.
- SHAW, H. M.  
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.  
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.  
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.  
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.  
“Soil Aldehydes” (Paper).—1919.
- SNOOK, HOMER CLYDE.  
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.  
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.  
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.  
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.  
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.  
“Propagation of Electric Waves Along Wires” (Paper).—1913.
- STRADLING, GEORGE F.  
“Modern Theories of Magnetism” (Paper).—1916.
- STUMPF, J.  
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.  
Radojet Air Pump.—1920.
- TAINTOR, C. C.  
Positive Saw-Set.—1895.

TAUSSIG, JOHN H., AND ZEEK, CHARLES F.

Automatic Operation of Water Gas Sets.—1918.

TEAL, B. F.

Anti-friction Universal Joint for Shafting.—1909.

THOMAS, C. C.

"Measurement of Gases" (Paper).—1912.

TIERNAN, MARTIN F., AND WALLACE, C. F.

Chlorinator.—1922.

TOERRING, C. J.

Electric Arc Lamp.—1903.

TOWNSEND, T. F.

Improved Thermometer Support.—1907.

TUCKER, W. H.

Letter and Document Files.—1900.

TURNER, W. V.

"Locomotive Air-Brake" (Paper).—1911.

TUTWILER, C. C.

"Recovery of Gas Works by-Products" (Paper).—1915.

ULRICH, FREDERICK L., AND EBERHARDT, H. E.

Radial-Duplex Gang Cutters.—1904.

UNDERWOOD, JOHN, AND COMPANY.

Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSPACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.

## CERTIFICATE OF MERIT AWARDS

1885-1923

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Elec'ric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIIDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H

"A New Theory of Plate Springs" (Paper).—1920.

McCHESNEY, R.

Improvements in T-Squares.—1893.

MacDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

McINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

REAGAN, JAMES.

Improved Gates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.





DESHLER, CHARLES, AND McALLISTER, EDWARD J.

Portable Photometer.—1900.

DeVOE, W. R.

Conduit Electric Railway.—1894.

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Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.



PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-Violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY, W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1919.

- SCHMIDT, MAX, AND SIEBER, JOSEPH.  
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.  
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.  
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.  
“Organic Constituents in Soils” (Paper).—1912.
- SCRIPTURE, E. W.  
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.  
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.  
Super-Centrifuge.—1916.
- SHAW, H. M.  
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.  
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.  
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.  
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.  
“Soil Aldehydes” (Paper).—1919.
- SNOOK, HOMER CLYDE.  
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.  
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.  
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.  
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.  
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.  
“Propagation of Electric Waves Along Wires” (Paper).—1913.
- STRADLING, GEORGE F.  
“Modern Theories of Magnetism” (Paper).—1916.
- STUMPF, J.  
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.  
Radojet Air Pump.—1920.
- TAINTOR, C. C.  
Positive Saw-Set.—1895.

TAUSSIG, JOHN H., AND ZEEK, CHARLES F.

Automatic Operation of Water Gas Sets.—1918.

TEAL, B. F.

Anti-friction Universal Joint for Shafting.—1909.

THOMAS, C. C.

"Measurement of Gases" (Paper).—1912.

TIERNAN, MARTIN F., AND WALLACE, C. F.

Chlorinator.—1922.

TOERRING, C. J.

Electric Arc Lamp.—1903.

TOWNSEND, T. F.

Improved Thermometer Support.—1907.

TUCKER, W. H.

Letter and Document Files.—1900.

TURNER, W. V.

"Locomotive Air-Brake" (Paper).—1911.

TUTWILER, C. C.

"Recovery of Gas Works by-Products" (Paper).—1915.

ULRICH, FREDERICK L., AND EBERHARDT, H. E.

Radial-Duplex Gang Cutters.—1904.

UNDERWOOD, JOHN, AND COMPANY.

Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSPACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.



WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.

## CERTIFICATE OF MERIT AWARDS

1885-1923

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

REAGAN, JAMES.

Improved Gates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.



- ADT, J. B.  
Tobacco Machine.—1901.
- AKELEY, CARL E.  
Cement-Gun.—1916.
- ALBERT, C. F.  
Musical Instruments.—1901.
- ALGER, H. C.  
Liquid Measurer.—1912.
- ALMOND, T. R.  
Angular Coupling.—1892.
- ALMOND, T. R.  
Flexible Tube.—1897.
- AMERICAN PRISMATIC LIGHT COMPANY.  
Light Projecting Glass.—1901.
- ANDERSON, H. N.  
Gear Rolling Machine.—1915.
- ANDERSON, LEVI.  
File Cutting.—1842.
- ANDERSON, WILLIAM.  
Apparatus for Water Purification.—1891.
- ASHFORD, HENRY.  
Boat Attaching and Detaching Apparatus.—1883.
- ATKINS, J.  
Self-Raking Automatic Reaper and Mover.—1854.
- ATKINSON, J.  
Gas Engine.—1889.
- BABBITT, I.  
Axle Boxes for Railway Cars.—1840.
- BABBITT, I.  
Soft Metal Boxes.—1842.
- BAEKLAND, LEO H.  
Bakelite.—1909.
- BAKER, J. G.  
Pressure Blower.—1875.
- BALDWIN, F. S.  
Calculating Machine.—1874.
- BALDWIN, F. R.  
Boiler Tube Cleaner.—1893.
- BALLENTINE, W. I.  
Apparatus for Testing Hardness and Density of Metal, etc.—1908.
- BALZER, S. M.  
Device for Backing off and Forming Milling Cutters.—1896.
- BARDWELL, JOHN.  
Votometer.—1901.

BASSETT, H.

Compasses.—1835.

BATCHELLOR, B. C.

Pneumatic Dispatch Tube Apparatus.—1899.

BATDORF, C. S.

Coin Counting and Wrapping Machine.—1914.

BATES, ALBERT J.

Improved Corliss Engine.—1895.

BATES, ROBERT.

Instrument for the Cure of Stammering.—1854.

BEADLE, C.; BEVAN, E. J.; CROSS, C. F.

Cellulose Products.—1895.

BEAN, E. W.

Device for Ascertaining Latitude.—1837.

BEECHER, JAMES.

Hollow Handled Cutlery.—1883.

BEHREND, B. A.

High Speed Electric Generators.—1909.

BEHRNS, G. L. H., AND BREMAR, A.

Aspirator for Mill Stones.—1877.

BELL, CHICHESTER A., AND TAINTER, SUMMER.

Apparatus for Recording Sound.—1900.

BENNOR, JOSEPH.

Siphon Trap.—1884.

BENNOR, JOSEPH.

Knitting Machine.—1892.

BERKEFELD, W.

Germ Proof Water Filter.—1893.

BERLINER, E.

Gramophone.—1897.

BEVAN, E. J.; BEADLE, C.; CROSS, C. F.

Cellulose Products.—1895.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BILGRAM, HUGO.

Gearing for Metal Planners.—1882.

BILYEU, THOMAS.

International Money Machine.—1917.

BLAKEY, THOMAS W., AND COURTENAY, WILLIAM.

Reconstructed Granite.—1900.

BLICKENSDECKER, GEORGE C.

Typewriting Machine.—1901.

BLODGETT BROTHERS.

Electrical Signal Clock.—1883.

BLONDEL, ANDRE, AND PAAROWDAKI, SPIRIDION.

Holophane Globes.—1898.

BRADLEY, ANDREW.

Stencil Machine.—1902.

BRAMWELL, W. C.

Feeding Machine for Fibrous Material.—1894.

BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.

Refrigeration Process.—1894.

BREHMER, HUGO, AND HEYL, HENRY RAND.

Wire Book Sewing Machine.—1883.

BREMAR, A., AND BEHRNS, G. L. H.

Aspirator for Mill Stones.—1877.

BRIDGMAN, H. L.

Automatic Ore Sampler.—1893.

BRILL, J. A.

Convertible Cars, Traction Trucks.—1904.

BRITTIN, J. W., AND TATHAM, B.

Safety Catch for Elevators.—1875.

BROWN, EDWARD.

Pyrometers.—1897.

BROWNING, JOHN M.

Automatic Pistol.—1906.

BURGER, H. J.

Photo-Polychrome Printing Apparatus.—1903.

BURRELL, JOHN H., AND METZLER, C. E.

Railway Signal Lantern.—1885.

BURROUGHS, W. S.

Calculating Machine.—1897.

BURROWS, AMOS E.

Feed-Water Regulator.—1904.

BURT, W. A.

Variation Compass.—1835.

BURTON, G. D.

Electric Forging Device.—1892.

BURTON, W. L.

Electric Heater.—1890.

CALAHAN, E. A.

Synchronous Multiplex Telegraphy.—1886.

CALDERHEAD, A.

Looms.—1840.

CAMPBELL, P. T. AND C. H.

Apparatus for Reconstructing Milk.—1904.

CARLETON, CYRUS, AND WILCOX, CHARLES H.

Automatic Tension and Improved Sewing Machines.—1875.

CARNELL, CHARLES.

Brick Machine.—1850.





COWPER-COWLES, SHERARD.

Method of Depositing Metals on Metallic Surfaces.—1911.

CREHORE, A., AND SQUIRE, G. O.

Polarizing Photo-Chronograph.—1896.

CROSS, C. F.; BEADLE, CLAYTON; BEVAN, E. J.

Cellulose Products.—1895.

CROSS, W. A.

Horizontal Folding Door.—1903.

CYCLOSTYLE COMPANY.

Cyclostyle.—1888.

DALE, JOHN D.

Wood Molding Machine.—1857.

DARLING, J. D.

Apparatus for Producing Metals and Nitric Acid from Fused Nitrates.—1901.

DAVIS, JOB A.

Vertical Feed for Sewing Machine.—1875.

DENISON, L. C.

Corn Sheller.—1839.

DIETZ, GUSTAV.

High Speed Photographic Between-lens Shutter.—1909.

DILKS, J.

Water Gauges.—1853.

DOBBINS, E. J.

Daylight Rod.—1914.

DOBBINS, EDWARD J., AND MOFFETT, GEORGE.

Light Projecting Glass.—1901.

DOBLE, W. A.

Tangential Water Wheel.—1904.

DOCK, H.

Rivet Thread Tool.—1901.

DODGE, J. M.

Storage Structure for Coal and Analogous Material.—1904.

DODGE, WALLACE H.

System of Rope Transmission.—1891.

DOERR, JOHN H., AND WIGMORE, WILLIAM H.

Sleeping Car.—1885.

DORR, JOHN V. H.

Hydrometallurgical Apparatus.—1916.

DOWNES, L. W.

Fireproof Insulated Wire.—1905.

DRESSLER, CONRAD D'HUC.

Tunnel Kiln.—1918.

DUNCAN, JOSEPH S.

Addressograph.—1903.

DUNHAM, JOSEPH M., AND MCKEMMIL, JOHN.

Metallic Drawing Tools.—1894.

DUNN, B. W.

Testing Machine for Measuring Intensities of Impulsive Forces.—1898.

DURKEE, G. B., AND GOLDING, JOHN F.

Expanded Metal.—1897.

DUTTON, R. & Co.

Mowing Machine.—1877.

ECKSTEIN, H. G.

Feed Water Heater.—1884.

EDISON, T. A.

Mimeograph.—1889.

EDSON, J. B.

Pressure Recording Gauge.—1894.

EHBETS, C. J.

Improved Revolver.—1890.

ELDRED, BYRON E.

Process for Flame Regulation.—1906.

ELDRIDGE, G. M.

Electro Magnetic Protector for Electric Instruments.—1884.

ELLIS, H.

Combined Calculating and Writing Machine.—1909.

ELMER AND LITTLE.

Chronometer.—1837.

EMERSON, J.

Power Scale.—1892.

EWBANK, T.

Lead Pipes.—1835.

FABER, GEORGE.

Magnetic Water Gage.—1853.

FAHY, FRANK P.

Permeameter.—1918.

FAWKES, JOSEPH W.

Steam Plow.—1859.

FELLOWS, E. R.

Machine and Cutter for Generating Gear Teeth.—1899.

FELT, D. E.

Comptometer.—1890.

FIELD, D. W., AND SPENCER, JOHN E.

Damper Regulator.—1893.

FISHER, ROBERT T.

Improved Book and Letter Typewriter.—1899.

FORTEN, R. B.

Telescope.—1840.

FOUCHE, E.; CLAUDE, G. M. A.; HESS, G. M.

Process for Storing Explosive Gases.—1902.

FRAHM, HERMANN.

Speed Indicator, Frequency Teller and Revolution Counter.—1907.

FRANCIS, JEROME B.

Tooth Extractor.—1860.

FRAZER, PERSIFOR.

Apparatus for Quantitative Colorimetry.—1905.

FULLER, FRED L., AND GRISWALD, GEORGE H.

Cash Register and Indicator.—1892.

FULLER, J. E.; BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.

Refrigeration Process.—1894.

FURBISH, ZACHARY T.

Ratchet Tools.—1904.

GARROD, R. P.

Annunciators.—1891.

GATES, JOHN.

Lubricator.—1888.

GIBBONS, C. L.

Street Railway Construction.—1892.

GILLESPIE, ALFRED J.

Voting Machine.—1902.

GLIDDENS, CARLOS; SHOLES, C. L.; SOULE, S. W.

Improved Typewriter.—1875.

GODDARD, K.

Carriage Axle.—1852.

GOETZ, G. M.

Device for Anchoring Beams.—1891.

GOLDBERG, H. E., AND WAHL, J. C.

Adding Machine.—1916.

GOLDING, J. F.; AND DURKEE, G. B.

Expanded Metal.—1897.

GOLDSTEIN, A.

Pneumatic Fire Alarm Telegraph System.—1895.

GOODES, E. A.

Sewing Machine.—1875.

GOODWIN, WILLIAM FARR.

Mowing Machine.—1879.

GOODYEAR, ROBERT B.

Harness Motion for Power Looms.—1875.

GOODYEAR, ROBERT B.

Shuttle Box Operating Mechanism.—1875.

GRANT, GEORGE B.

Calculating Machine.—1877.

- GRANT, GEORGE B.  
Calculating Machine.—1896.
- GRAU, PHILIP J.  
Feed Water Purifier and Heater.—1886.
- GREENE, E. V.  
Apparatus for Extracting Oil and Albuminoid from Corn.—1851.
- GRIMES, W. C.  
Water Gauge for Steam Boilers.—1851.
- GRIMES, W. C.  
Smut Machine.—1840.
- GRISWALD, GEORGE H., AND FULLER, FRED L.  
Cash Register and Indicator.—1892.
- GROUPE, A. V.  
Braiding Machine.—1900.
- GUILLAUME, C. E.  
Invar Alloy.—1914.
- HADFIELD, ROBERT A.  
Manganese Steel.—1891.
- HAHL, A. L.  
Pneumatic Clock.—1901.
- HAINES, ROBERT B., JR.  
Automatic Micrometer Rolling Mill Plate Gauge.—1901.
- HAKEWESSEL, REINHOLD, AND HENN, EDWIN C.  
Automatic Screw and Metal Working Machine.—1901.
- HALL, THOMAS.  
Typewriter.—1884.
- HALL, M. W.  
Duplex Steam Pump.—1886.
- HALLOCK, DAVID.  
Weighing Scale.—1887.
- HALLOWELL, HOWARD T.  
Pressed Steel Shaft Hangers.—1906.
- HAMMER, WILLIAM J.  
Apparatus for Long Distance Phonographic and Telephonic Experiments.—1902.
- HANNAY, J. B., AND SHEDLOCK, ALFRED.  
Lucigen.—1891.
- HANSON, HANS, AND HART, FREDERICK A.  
Calculating and Typewriting Machine.—1915.
- HARDINGE, H. W.  
Conical Pebble Mill.—1915.
- HARO, A LOPEX DE.  
Electric Sea Compass; Automatic Electric Log Line.—1890.
- HART, EDWARD.  
Acid Container.—1891.

HART, FREDERICK A., AND HANSON, HANS.

Combined Calculating and Typewriting Machine.—1915.

HART, WALTER.

Hoisting Machine.—1891.

HEANY, J. A.

Enclosed Arc Lamp.—1904.

HECTROTTE, A. G.

Car Coupling.—1848.

HELLINGS, J.

Mail Bag Fastener.—1890.

HENN, E. C., AND HAKEWESSEL, REINHOLD.

Automatic Screw and Metal Working Machine.—1901.

HERAEUS, W. C.

Fused Quartz Mercury Lamp.—1906.

HERAEUS, W. E.

Improvements on the LeChatelier Pyrometer.—1907.

HERMAN, HENRY O.

Star Ventilator.—1902.

HERR, H. A.

Liquid Extraction Apparatus.—1909.

HESS, G. A., CLAUDE, G. M. A., FOCHE, E.

Process of Storing Explosive Gases.—1902.

HEXAMER, C. J.

Apparatus for Preventing and Extinguishing Fires in Grinding Mills.—1888.

HEYL, HENRY R., AND BREHMER, HUGO.

Wire Book Sewing Machine.—1883.

HEYL, HENRY R.

Wire Fastened Paper Boxes.—1875.

HIGGINS, A., AND JACOBS, C. B.

Alundum Refractories.—1909.

HILL, T.

Calculating Instrument.—1843.

HOBSON, A. E.

Hydraulic Shaping Press.—1890.

HOLCOMB, A.

Reflecting Telescope.—1835.

HOPKINS, EDWARD P.

Electric Arc Lamp.—1896.

HOPKINS, N. M.

Pneumatic Water Pipe Cushioning.—1900.

HOUGH, JAMES, AND LAUGHLIN, SAMUEL.

Drawing Tables.—1900.

HUMPHREY, F. A.

Improved Sawing Machine and Guide.—1901.

HUMPHREY, H. A., AND CERASOLI, ALBERTO.

Hydraulic Pump.—1914.

HUTCHINS AND MABBITT.

Tilting Chair.—1875.

HYATT, I. S.

Purification of Water System.—1888.

HYATT, J. W.

Roller Bearings.—1898.

IHLDER, J. D.; SMITH, A. C.; SUNDH, AUGUST; OTIS, SIDNEY.

Electric Elevator.—1902.

IRWIN, JOHN H.

Lantern.—1873.

IVES, FREDERICK E.

Isochromatic Photography.—1887.

IVES, FREDERICK E.

Projecting Lantern and Appurtenances.—1890.

IVES, FREDERICK E.

Parallax Stereogram.—1904.

IVES, FREDERICK E.

New Form of Replica of Rowland Diffraction Grating.—1905.

IVES, FREDERICK E.

Color Meter.—1907.

JACKSON, WALTER W., AND CONNET, F. N.

Improved Venturi Meter.—1898.

JACOBS, C. B., AND HIGGINS, A. C.

Alundum Refractories.—1909.

JANDUS, WILLIAM.

Enclosed Arc Lamp.—1895.

JAY, PERRIE EGMOND.

Automatic Anti-Freezing Valve.—1885.

JENKINS, C. F.

Motion Pictures Apparatus.—1909.

JENKS, W.

Fire Arms.—1840.

JEWELL, M. R.; POWERS, T. B.; KELLY, J. F.

Telelectric Piano Player.—1910.

JOHNSON, A. L.

Bonding Joint for Electric Railways.—1896.

JOHNSON, E. H.

Interior Electric House Conduit.—1891.

JONES, ALFRED C.

Shaft Couplings.—1842.

JONES, EVAN W.

Underfeed Mechanical Stoker.—1904.

JONES, H. P.

Baling Machine.—1901.

JONES, J. R.

Method of and Apparatus for Axle Rolling.—1892.

KELLY, J. F.; POWERS, T. B.; JEWELL, M. R.

Telelectric Piano Player.—1910.

KEMBLE, B. H.

Wheel Hubs.—1883.

KENT, A. ATWATER.

Ignition System for Automobiles.—1914.

KITE, J. S.

Safety Beam.—1840.

KNEASS, S. L.

Injector.—1901.

KOYL, C. H.

Parabolic Semaphore.—1889.

KURTZ, DAVID T.

Cap Screws and Bolts.—1905.

LA RUE, S. H.

Stove for Soft or Bituminous Coal.—1893.

LATTIG, J. W.

Automatic Electric Semaphore Signal.—1904.

LAUGHLIN, SAMUEL, AND HOUGH, JAMES.

Drawing Tables.—1900.

LECLERE, FRANCIS.

Black Printing Process.—1897.

LECLERE, FRANCIS.

Toothed Gear Wheel.—1891.

LEONARD, H. W.

System of Motor Control.—1902.

LEVY, M. AND L. E.

Screens for Photo-Mechanical Engraving.—1897.

LEWIS, WILFRED; TABOR, HARRIS; MUMFORD, E.

Molding Machine.—1902.

LINCOLN, P. M.

Synchronism Indicator.—1902.

LITTLE AND ELMER.

Chronometer.—1837.

LOSS, HENRIK V.

Solid Steel Railway Wheels Manufactured by Hydraulic Forging with Rolling.—1904.

LOVEKIN, L. D.

Device for Relieving Forces due to Inertia and Weight of Valve Gears.—1910.



LOWE, J.

Spinning Mule.—1890.

LUNGREN, CHARLES M.

Incandescent Gas Light.—1892.

MACCOY, J. S.

Pneumatic Tool.—1890.

MCCALL, THOMAS A., AND PILLINGS, JOHN H.

Automatic Typewriter.—1917.

MCCAULEY, THOMAS, AND REED, C. J.

Speed-Jack.—1907.

MCCLELLAN, EZRA S.

Anti-Siphon Vent.—1892.

MCCRACKEN, EDWIN D.

Insulated Electrical Conductors.—1896.

MCINTIRE, C.

Electric Wire Connectors.—1890.

McKEE, M. A.

Process of Treating Printing Plates.—1912.

McKEMMIL, JOHN, AND DUNHAM, JOSEPH M.

Metallic Drawing Rolls.—1894.

McMAHAN, J.

Stereotyping Plate.—1835.

McMULLEN, JOHN.

Machine for Knitting Stockings.—1835.

MACHLET, GEORGE, AND REICHHELM, E. P.

Apparatus for Producing Fuel Gas.—1894.

MCCURDY, ARTHUR W.

Apparatus for Developing Photographic Roll Prints.—1904.

MADDOX, R. L.

Substitution of Gelatine for Collodion in Photography.—1889.

MAHAN, FRANCIS.

Measure Case Ruler.—1837.

MARCY, L. J.

Magic Lantern.—1887.

MARKS, A. A.

Artificial Limbs.—1889.

MARSDEN, M.

Corn-pith Cellulose.—1896.

MASON, A. J.

Washer Punching Machine.—1891.

MELLOR, L. B.

Device for Measuring and Recording the Variable Diameter of Tubes.—  
1903.

MERGENTHALER, O.

Linotype.—1889.

MERKET, LUZERNE, AND THOMAS, ALMER.

Tempered Copper.—1891.

MERRICK AND TOWNE.

Boring Machine.—1840.

MERSHON, R. D.

Compensated Potential Indicator.—1901. •

METZLER, CHRISTIAN E., AND BURRELL, JOHN H.

Railway Signal Lantern.—1885.

MEYERS, J. G.

Mausoleum.—1889.

MEYLAN, EUGENE, AND RECKNIEWSKI, CAMILLE S.

Electric Meter.—1893.

MILLER, D. K.

Self Locking Padlock.—1883.

MILLIAU, EDWARD.

Apparatus for Analyzing Fats and Oils.—1896.

MOFFET, GEORGE, AND DOBBINS, EDWARD J.

Light Projecting Glass.—1901.

MOORE, D. MCFARLAN.

Vacuum-tube Light.—1909.

MOORE, LEE C.

Wire Testing Machine.—1904.

MORRIS, HENRY G., AND SALOM, PEDRO G.

Electric Automobile.—1897.

MORSE, EVERETT F.

Heat Gage.—1903.

MORSE, EVERETT F.

Drive Chains.—1901.

MORSELL, W. F. C.

Complementary Color Designs and Crystal Patterns.—1894.

MOSER, L.

"Bohemian" Glassware.—1886.

MOSKOWITZ, MORRIS.

System of Car Lighting.—1900.

MUELLER, H. C.

Apparatus and Process for Manufacturing Mosaics.—1898.

MUMFORD, EDGAR; LEWIS, WILFRED; TABOR, H.

Molding Machine.—1902.

NACKF, ARNOLD.

Screw Cutting Attachment.—1883.

NAGLE, H. M.

Flat Bar or Edge Rail for Railroad Curves.—1842.

NERNST LAMP COMPANY.

Incandescent Lamp.—1906.

NICHOLS, H. B., AND VOYNOW, C. B.

Cast Zinc Joint for Rail-Bonding.—1906.

OLDS, CALVIN.

Planting Machine.—1840.

ORUM, MORRIS L.

Improved Lock.—1885.

ORUM, MORRIS L.

Mandrel for Bending Metal Pipes.—1875.

OTIS, SIDNEY; SMITH, R. C.; IHLDER, J. D.; SUNDH, AUGUST.

Electric Elevator.—1902.

OUTERBRIDGE, A. E., JR.

Method of Carbonizing Fabrics and Castings Therefrom.—1888.

OUTERBRIDGE, A. E., JR.

Method for Investigating the Molecular Physics of Cast Iron.—1897.

PAAROWDAKI, SPIRIDION, AND BLONDEL, ANDRE.

Holophane Globes.—1898.

PALMER, B. F.

Artificial Leg.—1849.

PALMER, FREDERICK; REYNOLDS, J. R.; TIRRELL, J. P.

Engine Stop and Speed Limit System.—1906.

PARKER, ZEBULON.

Water Wheel.—1847.

PARKINSON, EDWARD.

Knitting Machine.—1905.

PARSONS, L. H.

Scale Measure.—1852.

PATTERSON, H. G.; PATTERSON, J. G.; CARNEY, T.; COOK, H.

Cash Registers.—1901.

PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.

Cash Registers.—1901.

PAYEN, C.

Chloride Electrical Storage Battery.—1894.

PEALE, F.

Coining Presses at the United States Mint, Philadelphia.—1840.

PENTZ, A. D.

Boring and Milling Engine.—1891.

PERRY, N. W.

Method of Series Electric Traction.—1894.

PFATISCHER, MATTHIAS.

Variable Speed Motors.—1909.

PHELPS, L. J.

Induction Telegraph.—1886.

PHOENIX IRON COMPANY.

Automatic Cut-Off Steam Engine.—1886.

PILLINGS, JOHN H., AND MCCALL, THOMAS A.

Automatic Typewriter.—1917.

PONTRICHET, J.

“Heliographic” Paper.—1894.

POOLE AND COMPANY, J. MORTON.

Grinding Metallic Calendar Rolls.—1875.

POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.

Teleelectric Piano Player.—1910.

PRATT AND WHITNEY COMPANY.

Taps and Gauges.—1883.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PRENTISS, H. S.

Automatic Calendar.—1896.

PRIESTMAN, W. D. AND SAMUEL.

Steam Engine.—1894.

PRUNTY, JOHN E.

Relief Valve.—1875.

PRUTZMAN, A.

Door Lock.—1836.

REAGAN, J.

Grate Bars.—1908.

RECEVEUR, P. N.

Rose Engine (Lathe).—1853.

RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.

Electric Meter.—1893.

REDDAWAY, FRANK.

Camel Hair Belting.—1898.

REED, CHARLES J., AND MCCAULEY, THOMAS.

Speed-Jack.—1906.

REICHHELM, E. P., AND MACHLET, GEORGE.

Apparatus for Producing Fuel Gases.—1894.

RENO, J. W.

Escalator.—1910.

REYNOLDS, J. R.; PALMER, FREDERICK S.; TIRRELL, J. P.

Engine Stop and Speed Limit System.—1906.

RHOADS, J.

Map for the Blind.—1840.

RICHARDS, J.

Solder for Aluminum.—1896.

RICHARDS, J.

Balance for Testing White Metal Alloys.—1901.

RICHARDS, T. A.

Ruling Machine.—1890.

RICHARDSON.

Eccentric Door Spring.—1840.

RICHARDSON, J. H.

Signal Lantern.—1868.

RIDGWAY, T. S., JR.

Transit Theodolite.—1839.

RIDGWAY, W. H.

Balanced Crane.—1890.

RIEFLER, SIGMUND.

Mercurial Compensation Pendulum.—1894.

RITCHIE, E. S.

Improved Rhumkorff Coil.—1860.

RITES, F. M.

Perfecting of Shaft Governor System.—1902.

ROEDER, F. A., AND SPRINGER, ALFRED.

Torsion Balance.—1891.

RONDINELLA, L. F.

Photo-Printing Machine.—1905.

ROOT, J. B.

Spiral Weld Tubing.—1890.

ROOTS, P. H. AND F. M.

Rotary Pressure Blower.—1875.

RORER, T. J.

Belting.—1875.

ROSENBAUM, WALTER A.

Automatic Hydraulic Letter Copying Press.—1905.

SACHS, J.

Enclosed Fuse Protective Devices.—1903.

SALOM, PEDRO G., AND MORRIS, HENRY G.

Electric Automobile.—1897.

SARGENT, C. E.

Expansion Gas Engine.—1907.

SAYEN, H. L.

Improved Roentgen Ray Tubes.—1898.

SAXTON, J.

Reflecting Pyrometer.—1842.

SHELLENBACH, WILLIAM S.

System of Gearing.—1902.

SCHMIDT, M. E.

Moving Platform.—1906.

SCHOOP, MAX ULRICH.

Metal Spraying Process.—1917.

SEE, H.

Hydro-Pneumatic Ash Ejector.—1904.

SEMPLE, J. B.

Shell Torch or Tracer.—1905.

SENNEFF, JACOB.

Eye-Harness for Metallic Heddle.—1853.

SEVERY, M. L.

Printing Machine.—1898.

SEYMOUR, C.

Balancer for Pulleys, Fly Wheels, etc.—1878.

SEXTON, A.

Slide Rule.—1899.

SHAW, T.

Instrument for Testing Ignitable Gases in Mines.—1889.

SHAW, THOMAS.

Gunpowder Pile Driver.—1872.

SHAW, THOMAS.

Spiral Exhaust Nozzle.—1877.

SHAW, THOMAS.

Friction Buffer.—1883.

SHAY, EPHRAIM.

Geared Locomotive.—1892.

SHEDLOCK, ALFRED, AND HANNAY, J. B.

Lamp for Engineering Uses.—1891.

SHIMER, P. W.

Combustion Crucible.—1901.

SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.

Typewriter.—1875.

SHORE, A. F.

Scleroscope.—1909.

SHUMAN, F. S.

Wired Glass.—1894.

SHUMAN, F.

Concrete Pile for Foundations.—1904.

SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.

Electric Elevator.—1902.

SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.

Typewriter.—1875.

SPEIDEL, J. G.

Hoisting Machines.—1891.

SPELLIER, L. H.

Electric Clock.—1887.

SPENCER, J. E., AND FIELD, D. W.

Damper Regulator.—1893.

SPERRY, E. A.

Gyroscope Compass.—1914.

SPIELMAN, A.

Cloth Cutting Machine.—1914.

SPIRO, C.

Barlock Typewriter.—1894.

SPRATT, ORLANDS, W.

Mercury Seal Trap.—1885.

SPRINGER, ALFRED, AND ROEDER, F. A.

Torsion Balance.—1891.

SQUIER, G. O., AND CREHORE, A.

Polarizing Photo-Chronograph.—1896.

STACKHOUSE, THOMAS H.

Diagraph.—1895.

STAHLBERG, C.

Time Dating Stamp.—1891.

STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.

Refrigeration Process.—1894.

STEINBART, ALFRED, AND UEHLING, EDWARD.

Pneumatic Pyrometer.—1898.

STEINBART, ALFRED, AND UEHLING, EDWARD.

Gas Composimeter.—1899.

STELLWAGON, H. S.

Sounding Apparatus.—1848.

STIERINGER, L.

Improved Method of Electric Illumination.—1902.

STREET, CLEMENT F.

Locomotive Stoker.—1915.

STRICKLAND, W.

Substitution of Lime for Salt for Preserving Lumber.—1840.

SUNDH, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.

Electric Elevator.—1902.

SWEETLAND, ERNEST J.

Filter Press.—1918.

SWENSON, MAGNUS.

Round Lap Baling Cotton Compress.—1900.

TABER, HARRIS; LEWIS, WILFRED; MUMFORD, E.

Molding Machines.—1902.

TAINTER, SUMMER, AND BELL, CHICHESTER A.

Apparatus for Recording Sound.—1900.

TALBOT, E.

Improved Methods in the Manufacture of Steel.—1908.

TATHAM, B., AND BRITTIN, J. W.

Safety Catch for Elevators.—1875.

TATTERSALL, ALFRED R.

Flour Mill.—1917.

TAYLOR, C. M., JR.

Absorption Process for Butter Making.—1903.

TEAL, C. A.

Portable Hoist.—1889.

THOMAS, ALMER, AND MERKET, LUZERNE.

Tempered Copper.—1891.

THOMSON, ELIHU.

Electric Welding.—1889.

THOMSON, ELIHU.

Constant Current Arc Light Transformer.—1901.

THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.

Refrigeration Process.—1894.

THUM, CHARLES D.

Varnish Brushes.—1854.

TIRRILL, A. A.

Voltage Regulator.—1910.

TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.

Engine Stop and Speed Limit System.—1906.

TOWNSEND, ISAAC.

Tent Fastening.—1885.

TWEDDELL, R. H.

Method of Applying Hydraulic Power to Mechanical Work.—1894.

TYLER, PHILOS B.

Shifting Gauge Cock for Steam Boilers.—1835.

TYSON, CHARLES.

Machine to Unite Uppers to the Soles of Shoes.—1875

UEHLING, EDWARD, AND STEINBART, ALFRED.

Gas Composimeter.—1899.

UEHLING, EDWARD, AND STEINBART, ALFRED.

Pneumatic Pyrometer.—1898.

VAN KANNEL, T.

Storm Door.—1890.

VAUCLAIN, SAMUEL M.

Truck Wheel Centres.—1891.

VILLEROI, M.

Telescope.—1849.

VOYNOW, C. B., AND NICHOLS, H. B.

Cast Zinc Joint for Rail Bonding.—1904.

WAHL, J. C., AND GOLDBERG, H. E.

Adding Machine.—1916.

WAIT, W. B.

Machine for Tangible Writing for Touch Reading.—1900.

WALE, GEORGE AND COMPANY.

Projection Lantern.—1875.





WINSLOW, S. E.

Pivot Scale Beam.—1840.

WIRT, CHARLES.

Rheostat.—1902.

WOOD, R. W.

Diffraction Color Photography.—1907.

WOOD, THOMAS.

Fountain Pen.—1839.

WOODBURY, C. J. H.

Electric Light Main Testing Apparatus.—1884.

WOODRUFF, W. N.

System of Keying for Machinery.—1888.

WOOTEN, J. E.

Locomotive and Boiler.—1890.

WURTZ, A. J.

Lightning Arrestors and Non-Arcing Metal.—1894.

YARYAN, H. T.

System of Evaporation in Vacuo.—1886.

YEOMANS, LUCIEN I.

Method of Machine Construction.—1917.

ZIEGLER, G. W.

Trestles and Scaffolding.—1888.



**Thursday, October 26, 1922—"Highspeed Photography of Vibrations" (Sound, Mechanical, Electrical, etc.)**

BY AUGUSTUS TROWBRIDGE, PH.D., D.S.M., D.S.O., Chev. L.H., Professor of Physics, Princeton University, Princeton, New Jersey

The lecturer will discuss first the essential instrumental features which should be embodied in both the recording and the indicating members of apparatus designed to record accurately minute and rapid vibrations.

Following this he will illustrate by means of lantern slides how these features have been incorporated in a satisfactory practical working instrument. The instrument itself will be shown and records of simple and complicated vibrations will be made during the course of the lecture.

Finally the lecturer will illustrate by means of lantern slides an important use to which the instrument has been put during the past two years; viz: the study of the pressure and volume changes in the cylinder of the modern high speed internal combustion engine. (Automobile engine under varying conditions of fuel mixture, spark setting and speed.)

**Thursday, November 2, 1922—"The Spectrum of Neutral Helium and the Behavior of Its Two Electrons."**

BY LUDWIK SILBERSTEIN, PH.D., Research Laboratory, Eastman Kodak Company, Rochester, N. Y.

After a short description of the principles of modern spectroscopic theory the lecturer will give an account of his investigations on the spectrum lines of neutral helium tending to show that the majority of these lines can be accounted for by assuming that the two electrons in a helium atom do not disturb each other to any appreciable extent, either electron being mainly controlled by the nucleus only. The subject is of especial interest, as hitherto none of these spectrum lines has been accounted for theoretically and as the said behavior of the electrons throws some curious light upon the problem of atomic structure in general.

**Thursday, November 9, 1922—"Structural Colors in Feathers."**

BY WILDER D. BANCROFT, PH.D.

World War Memorial Professor of Physical Chemistry, Cornell University, Ithaca, New York.

Reds, yellows, and blacks are pigment colors in feathers, while whites, blues, greens, and all the metallic colors are structural colors. A brief account of structural colors is given and it is then shown that the non-metallic blues are Tyndall blues and are due to the scattering of light by minute air bubbles in the walls of the cells. Non-metallic greens are structural blues with a superposed layer of pigment yellow.

The metallic colors are interference colors, being due to thin films. There is no bright-colored pigment in the feathers of the peacock or of the



the latent image which is produced by the action of light upon the grains. Some workers hold that the grains contain centers of sensitiveness formed when they are made, while others consider that centers are produced by the action of the light, one theory being that light acts in discrete units, each unit having the energy of a quantum. These various theories are discussed and suggestions made for further work upon the subject.

Illustrated by lantern slides.

**Thursday, December 14, 1922—"The Earliest Apparatus and Procedures of Photography: Contributions to The Centenary of Modern Photographic Methods."**

By HENRY LEFFMAN, A.M., M.D., Lecturer on Research.

Philadelphia College of Pharmacy and Science, Philadelphia, Pennsylvania.

Making pictures by the use of a camera dates from the invention of the Daguerreotype, announced in 1839, but Niépce had produced a picture by contact under the influence of light in 1822. Long prior to that period the fact that light changes various substances had been discovered. The lecture will be an outline of these earlier discoveries, both as regards cameras and procedures and will be illustrated with experiments and lantern slides.

**Wednesday, December 20, 1922—"Unsolved Problems of Cosmical Physics."**

By W. F. G. SWANN, D.Sc.

Professor of Physics, University of Minnesota, Minneapolis, Minnesota.

A discussion of the status of our knowledge of the earth's magnetic and electric phenomena. The origins of magnetic storms, earth-currents, the aurora borealis, and their relations to the sun's activity.

The status of our knowledge of the origin of gravitation and the bearing of Einstein's Theory upon gravitational phenomena.

**Thursday, January 11, 1923—"The Principles of Electrical Vibration Instruments."**

By A. E. KENNELLY, D.Sc.

Professor of Electrical Engineering, Harvard University and Massachusetts Institute of Technology, Cambridge, Mass.

These instruments are not only important from the practical standpoint, owing to their extensive every-day use, but their working theory bears remarkable analogies to alternating electric current theory. Some of these analogies are already known, but use is made of the motional-impedance circle for analyzing the behavior of these instruments comparatively. The principles of electrical vibration instruments, therefore, commend themselves to the notice of both mechanical engineers and electrical engineers. The lecture is illustrated by lantern slides showing the experimental methods which have been employed in the analysis.



**Thursday, February 8, 1923—"Tidal and Current Work of the Coast and Geodetic Survey."**

By G. T. RUDE, Lieutenant Commander; Chief, Division of Tides and Currents,  
U. S. Coast and Geodetic Survey, Washington, D. C.

An outline will be made of the activities of the Coast and Geodetic Survey in tidal and current work, with special reference to recent investigations in the subject of wind-driven currents.

A non-mathematical explanation of the forces governing the making of the tides and currents and examples of the different types of tides and currents.

Relation and importance of tides and currents to the work of the engineer, mariner and scientist.

A brief description of the instruments and methods employed in the observation and prediction of tides and currents.

Illustrated by lantern slides.

**Thursday, February 15, 1923—"The Structure and Constitution of Alloys."**

By WALTER ROSENHAIN, D.Sc., F.R.S.

Superintendent, Metallurgy Department, The National Physical Laboratory,  
Teddington, England

Emphasizing the increasing importance of full detailed knowledge of the internal structure and constitution of alloys, the lecture will review the methods of studying structure and constitution which have been recently developed, and some of the more important results obtained. The methods dealt with will include those relating to the thermal study of alloys by means of heating and cooling curves, and their interpretation. Principal importance, however, attaches to the microscopic examination of alloys in various states obtained by special methods of preparation, including prolonged annealing at carefully controlled temperatures, very gradual cooling, and quenching from accurately-known temperatures. The applications of these methods to the fundamentally important problem of determining the solubility of metals in one another in the solid state, and to the study of ternary and other complex alloys, will be described, with special reference to alloys of aluminum whose structure, constitution and properties have recently been investigated in the lecturer's laboratory.

Illustrated by lantern slides.

**Wednesday, February 21, 1923—"The Main Piers of the Bridge over the Delaware River, between Philadelphia and Camden."****I—DESIGN**

By CLEMENT E. CHASE, C.E.,

Principal Assistant Engineer, Delaware River Bridge Joint Commission

The great main towers of the bridge, rising 380 feet above high tide in the Delaware, are to be supported on granite and concrete piers, starting from





Possibilities mentioned and results already obtained by using high frequency induction.

Demonstration of heating with ironless induction.

Some problems of high temperature research listed and a plea made for increase of interest in this subject.

### **Thursday, March 8, 1923—"Ionization and Resonance Phenomena."**

BY CHARLES B. BAZZONI, Ph.D.

Professor of Experimental Physics, University of Pennsylvania,  
Philadelphia, Pa.

The modern theories of atomic structure in which the properties of materials are related to the groupings of electrons in the atoms are to a large extent checked experimentally by determinations of ionization and resonance potentials. These quantities are intimately connected with the structure and stability of the atoms and with the production of the ordinary optical spectra.

The speaker will outline briefly the development of the dynamic theories of atomic constitution including recent refinements. Certain experimental methods used to investigate the stability of atomic and molecular systems will then be described and discussed, and finally the way in which the production of spectral series depends upon the electronic arrangements will be brought out. The attempt will be made to show in a non-technical way the state of our knowledge in this rapidly changing field at the time of the lecture.

Illustrated by lantern slides.

### **Thursday, March 15, 1923—"Radiation and Chemical Reaction."**

BY HERBERT S. HARNED, Ph.D.

Assistant Professor of Physical Chemistry, University of Pennsylvania,  
Philadelphia, Pennsylvania.

Chemical reaction velocities in general. Monomolecular reactions and their temperature coefficients. Theories of Arrhenius, Marcellin and Rice. Thermal radiation theory of chemical reaction developed by W. C. McC. Lewis, Perrin, Tolman, Dushman and others. Reactions stimulated by visible and ultra violet radiation. The Einstein photochemical equivalent law. Are all chemical reactions photochemical?

Illustrated by lantern slides.

### **Wednesday, March 21, 1923—"Measuring Ocean Depths by Acoustical Methods."**

BY HARVEY C. HAYES, Ph.D., Research Physicist, U. S. Navy

This lecture will deal in general with the measurement of distances by acoustical methods and in particular with the measurement of submarine distances and the determination of submarine contours. The history of the



**Monday, April 9, to Friday, April 13, 1923, inc.—“The Electron in Chemistry.”**

BY SIR JOSEPH JOHN THOMSON,  
O.M., F.R.S., LL.D., Ph.D., D.Sc.,  
Master of Trinity College,  
Cambridge, England

**Monday, April 9, 1923—Lecture 1.**

The Atomic Theory had little effect on the progress of chemistry as long as nothing was known about the structure of the atom. The discovery of the electron showed that atoms have a structure and gave a clue to its character. The arrangement of the electrons in the atom. Number of electrons in the atom. Electronic Isomers. Active nitrogen. Instability of configuration when electrons are too crowded. Eight the maximum number of electrons which can be on the outer layer of an uncharged atom. This result involves a periodicity in the properties of the atoms of the different elements such as is expressed by Mendeleef. Periodic Law. Valency. The size of atoms. Specific Inductive capacity. Work required to abstract an electron from an atom. Methods for testing the configuration of electrons in an atom.

**Tuesday, April 10, 1923—Lecture 2.**

The combination of atoms to form molecules. Physical interpretation of chemical “bonds.” Double bonds. Union of two similar atoms to form a molecule. Union of two or more dissimilar atoms. “Positive and negative” valencies. Arrangement of electrons in Octets. Comparison with the results of the old valency rules. Stability of systems of Octets. Instability chains of Octets in general. Stability of  $\text{CH}_2$  chains. Polar molecules. Importance of these in chemical reactions. Problem of the water molecule. Arrangement of the electrons in chlorides, chlorates, perchlorates, carbonates, sulphates, sulphites, nitrates, nitrites. Connection between the arrangement of the electrons and the acidic or basic properties of the compound.

**Wednesday, April 11, 1923—Lecture 3.**

Mechanism of chemical combination. Active *molecules*. Their occurrence in such reactions as the combination of hydrogen with chlorine or of oxygen with hydrogen. Afford a physical basis for Thiele's theory of partial valencies. “Molecular compounds.” “Residual Affinity.” Double salts. Electron Theory gives a physical basis for Werner's Co-ordination Theory. Mechanism of Electrolytic Dissociation. Structure of the ions in liquids. Catalytic Action. Variable Valency and Homologous Elements.

**Thursday, April 12, 1923—Lecture 4.**

Connection between variable valency and the magnetic properties of the elements. Magnetism of chemical compounds. Magnetism of oxygen. Dia-



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 BETTS, WILLIAM C., 1844  
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 BOLTON, JAMES M., 1830  
 BONINE, CHARLES E., 1921-  
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 BRIGGS, ROBERT, 1867-1873  
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 COPPER, JOHN C., 1851  
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 CRAMP, CHARLES H., 1864-1867, 1875,  
 1895-1897  
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 CRESSON, JOHN C., 1835-1853  
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RIEHLE, HENRY J., 1826-1827	SPANGLER, HENRY W., 1891-1893
ROBBINS, SAMUEL J., 1827-1833	STEVENSON, WILLIAM, JR., 1828
ROBERTS, ALGERNON S., 1828	STEWART, THOMAS S., 1842-1850, 1852-1863
ROBERTS, PERCIVAL, 1864-1868	STRICKLAND, WILLIAM, 1828
ROBERTS, SOLOMON W., 1842-1847	STRUTHERS, JOHN, 1827-1849
ROBINSON, ALEXANDER P., 1911-1916	TABER, GEORGE, 1839-1842
ROGERS, EVANS, 1854-1863	TATHAM, WILLIAM P., 1870-1878, 1886-1887
ROGERS, HENRY D., 1838-1843	THOMPSON, AMBROSE W., 1839-1843
ROGERS, JAMES S., 1909-	THOMSON, ELIHU, 1878-1881
ROGERS, ROBERT E., 1867	THORNE, WILLIAM H., 1881-1897
RONALDSON, CHARLES E., 1885-1893, 1908-1912	THORNLEY, JOHN, 1851
ROSENGARTEN, GEORGE D., 1912-	TILGHMAN, BENJ. C., 1871-1875
ROWLAND, JAMES, JR., 1829-1830	TOPPAN, CHARLES, 1831-1832
ROWLAND, WILLIAM, 1828	TOWNE, JOHN H., 1840-1857, 1869
RUSH, WILLIAM, 1825	TOWNSEND, EDWARD Y., 1866-1867
RUST, JAMES I., 1824	
SADTLER, SAMUEL P., 1888-1897	

## MANAGERS—(Continued)

- TRACY, ELIASHIB, 1851  
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857  
 TRAUTWINE, JOHN C., JR., 1891-1895  
 TREGO, CHARLES B., 1837-1846  
 TREVOR, JOHN B., 1832  
 TROTH, HENRY, 1837-1841  
 TRYSON, GEORGE W., 1831-1833  
 TUTWILER, C. C., 1920-1923  
 TYLER, RUFUS, 1826-1837  
 VAUCLAIN, SAMUEL M., 1898, 1906  
 VAUX, GEORGE, JR., 1898-1899  
 WALLIS, J. T., 1923-  
 WALTER, JOSEPH S., JR., 1834-1837  
 WALTER, THOMAS U., 1829-1831, 1840-1851  
 WARDER, WILLIAM S., 1825-1827  
 WARNER, JOHN S., 1837-1843  
 WEAVER, JACOB, 1856-1857  
 WEAVER, JOHN J., 1880-1891  
 WEIGHTMAN, WILLIAM, 1862-1863  
 WETHERILL, CHARLES, 1835  
 WETHERILL, J. P., 1902  
 WETHERILL, JOHN P., 1824-1825  
 WETHERILL, WILLIAM, 1832  
 WETHERILL, WILLIAM C., 1916-  
 WEYGANDT, THOMAS J., 1851-1863  
 WHARTON, WILLIAM, JR., 1871  
 WHITAKER, GEORGE P., 1851-1852  
 WHITE, CHARLES H., 1828-1835  
 WHITE, SAMUEL S., 1864-1867  
 WHITNEY, ASA, 1846-1850  
 WHITNEY, GEORGE, 1858-1860  
 WHITNEY, JAMES S., 1862-1863, 1865-1869  
 WHITNEY, JOHN R., 1861  
 WICKHAM, M. T., 1824  
 WIEGAND, JOHN, 1831-1853  
 WIEGAND, S. LLOYD, 1864, 1890-1893  
 WILLIAMS, EDWARD H., 1871-1872  
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863  
 WILSON, JOSEPH M., 1869-1886  
 WILSON, O. HOWARD, 1864-1869  
 WOLBORN, CORNELIUS A., 1844-1850  
 WOLF, OTTO C., 1897-1913  
 WOOD, ALAN, 1845-1863  
 WOOD, SAMUEL R., 1824-1825  
 WOOD, WALTER, 1903-1912  
 WOOTEN, JOHN E., 1860-1862  
 YARDLEY, WILLIAM, JR., 1829  
 YEAGER, JOSEPH, 1832  
 YOUNG, ANDREW, 1828-1830



## PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS, 1834-1925

BACHE, ALEXANDER D., 1834-1836, 1839-1844	HOADLEY, GEORGE A., 1911-1912
BARNES, JAMES, 1922-1923	KOENIG, G. A., 1888-1889
BEARDSLEY, ARTHUR, 1892-1895	LEVY, LOUIS E., 1901-1902
BENZON, GEORGE H., JR., 1924-1925	LEWIS, WILFRED, 1912-1913
BILGRAM, HUGO, 1906-1907	MARBURG, EDGAR, 1899-1900
BONINE, CHARLES E., 1916-1917	MARKS, W. D., 1881-1882, 1887-1888
CALVERT, HAROLD, 1925-	MASLAND, CHARLES W., 1921-1922
CHRISTIE, JAMES, 1897-1898	McCONNELL, JACOB Y., 1909-1910
CLAMER, G. H., 1915-1916	ORR, HECTOR, 1880-1881
CONARD, THOMAS P., 1902-1903	PATTERSON, R. M., 1836-1839
CREIGHTON, H. JERMAIN, 1918-1919	PENROSE, CHARLES, 1920-1921
CRESSON, J. C., 1844-1874	ROGERS, JAMES S., 1908-1909
CRISFIELD, J. A. P., 1913-1914	RONALDSON, CHARLES E., 1903-1904
ELDRIDGE, G. MORGAN, 1896-1897	RONDINELLA, L. F., 1898-1899
FRANKLIN, BENJAMIN, 1919-1920	SARTAIN, SAMUEL, 1895-1896
FULWEILER, W. H., 1923-1924	SELLERS, COLEMAN, 1875-1880
GOLDSMITH, EDWARD, 1905-1906	SPANGLER, H. W., 1890-1891
GRIGGS, WILLIAM O., 1907-1908	SPENCER, THOMAS, 1910-1911
HAUPT, LEWIS M., 1904-1905	WETHERILL, WM. CHATTIN, 1917-1918
HENDERSON, GEORGE R., 1914-1915	WIEGAND, S. LLOYD, 1889-1890, 1891- 1892
HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901	

## THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the Museum of Models and Historical Apparatus.

### THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of Switzerland since 1888, of the United States since 1790. The specifications of French patents 1791 to 1900 and abstracts of the patents



Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

## THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active coöperation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

## THE FRANKLIN JOURNAL AND MECHANICS' MAGAZINE,

UNDER THE PATRONAGE OF

THE FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE  
MECHANIC ARTS, EDITED BY DR. THOMAS P. JONES, PROFESSOR OF  
MECHANICS IN THE INSTITUTE."



roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-seven years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its School has been suspended.

## LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenter's Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically preëmpted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences baring thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation, The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and



**MODELS AND HISTORICAL APPARATUS**

This collection includes the electrical machine used by Dr. Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Dr. Priestley's air pump, brought by him to America in 1794; odometre used by Dr. Franklin when postmaster general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1" locomotive built for the Stockton's and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.





blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock The Corner Stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone, a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Munroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanics Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Mifflin, A. G. Ralston.



of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steamboats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Professor Walter R. Johnson, Matthias W. Baldwin, Frederick Graff and Isaiah Lukens. While the work of the Committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the Committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the Committee with its extensive report appeared in the issues of the JOURNAL of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May, 1836, and the results of the investigations on the strength of materials with numerous illustrations and detailed descriptions of original apparatus appeared in the JOURNAL February to August, 1837.

1831, October 4 to 8 inclusive, seventh exhibition of domestic manufactures held in Masonic Hall. Visitors exceeded forty thousand. Eighty-nine premiums were proposed of which fifteen were adjudged due. Fifteen additional premiums were recommended. A silver medal and one hundred dollars were awarded for a cast iron cooking stove for anthracite coal. Five hundred and forty-two articles were exhibited.

1832. Commenced an investigation into the resources of the Commonwealth considered in relation to its industry and manufactures, an occasion which led to a geological survey of the State.

Walter R. Johnson presented a notable communication on "The Strength of Cylindrical Steam Boilers." The results given are based on the extensive series of experiments made by the Institute's Committee on the Explosion of Steam Boilers.

1833. The Institute was requested by the State Legislature to examine and report upon a bill relating to weights and measures and admeasurement reported to the House of Representatives June 26, 1833. A special committee



apparatus, harness, etc. A chandelier with thirty-eight lights made for the Senate Chamber of the State of Mississippi was one of the striking exhibits.

1839. The JOURNAL for November, 1839, contained a full translation by Professor John F. Frazer of the paper "Practical Description of the Process Called the Daguerreotype, which Consists in the Spontaneous Reproduction of the Images of Natural Objects in the Camera Obscura, not with Their Colours, but with Great Delicacy in the Gradation of Tints" presented to the French Academy by Daguerre.

1840. A detailed review of Dr. Alexander Dallas Bache's report on education in Europe to the Trustees of Girard College for Orphans appeared in the JOURNAL for January (the report, covering nearly seven hundred pages, was made for use in connection with the organization of Girard College, of which Dr. Bache was President).

October 7 to 21 inclusive, eleventh exhibition of domestic manufactures held in Masonic Hall. Silver medals were awarded for cotton and woolen goods, specimens of iron and steel, hardware and cutlery, a cooking stove, a piano, wall paper, etc. Over one thousand exhibits.

October 18 to 31 inclusive, twelfth exhibition of American manufactures held in the Philadelphia Museum Building, northeast corner of Ninth and Sansom Street and Welch's Olympic Circus, Walnut Street west of Eighth. No exhibition passed this in point of quality. About nine hundred exhibits.

1843. A request from City Councils for information on the best modes of paving highways. This question was referred to the Committee on Science and the Arts and a subcommittee of eight members was at once appointed. A voluminous report was presented, which gave careful consideration to all phases of the subject. The best construction of asphalt, wood and stone pavements was described. Pavements especially suitable to Philadelphia were noted, as well as plans and specifications, and superintendence and manner of executing the work. The report was accompanied by a map of Philadelphia showing the soils and drainage between the Delaware River and the Schuylkill River, and South Street on the South and Vine Street on the North.

October 17 to 28 inclusive, thirteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for printed cotton goods, longcloths, gentlemen's boots and slippers, artificial teeth, etc.

1844, October 14 to 30, fourteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-nine silver medals were awarded for cotton and woolen goods, hardware and cutlery, glass ware, etc., and one hundred and fifty-four certificates of Honorable Mention.

1845, October 21 to November 1 inclusive, fifteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-one first-class premiums were recommended, two hundred and sixteen awards in all. Seventy thousand visitors.

1846, October 20 to 31 inclusive, sixteenth exhibition held in the Philadelphia Museum Building. Silver medals were awarded for gloves, specimens of rolled iron, lamps and gas fixtures, wire rope, coach harness, window shades, musical instruments, etc.



## YEAR BOOK OF

~~From 1858 to 1860~~ were offered for perfumery and soaps, straw goods, chemicals, leather, dental materials, surgical instruments.

~~From 1861 to 1862~~ 21 to 29 inclusive, twenty-fifth exhibition of American ~~products~~ in Dr. Jayne's building on Dock Street. Silver medals for specimens of rolled iron, hardware, stoves and heaters, lamps and gas fixtures, silver ware and jewelry, cotton and woolen ~~goods~~ etc. 1226 exhibits.

~~From 1863 to 1864~~ 15 to November 13, twenty-sixth annual exhibition of American ~~products~~ held in the State Armory Building and adjacent grounds (Sixth and Subert Streets). Awards were made for musical instruments, books, printers' type and materials, boots and shoes, needlework, coachwork, philosophical apparatus, glass and china, lamps and gas fixtures, etc. A special pamphlet report on the sewing machines deposited ~~at the~~ exhibition was published in 1859.

~~From 1865 to 1866~~ The Guardians of the Poor requested the Institute to communicate the most efficient means of protecting the Alms House Buildings ~~from~~ burning.

A subcommittee of the Committee on Science and the Arts, to whom the ~~question~~ was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected ~~to~~ grounded. Detailed directions were given for making this installation.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulæ were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to Mechanical and Engineering Associations and Institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton, attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation





## YEAR BOOK OF

it can be ascertained which oils or  
which are unsafe. To make it a  
it knowingly use any oil or  
in case of death  
be liable to

seventh exhibition of  
Railroad Station, Thirteenth  
Vanamaker Store). Held to  
the Institute. Number of exhibi-  
missions—two hundred and sixty-  
Two hundred and one silver  
bronze medals and two hundred and  
mention were awarded.

Councils June 5 requested the Mayor to appoint  
practical engineers to be selected from not  
by the Board of Managers of The  
with the Chief Engineer of the Water  
the entire subject of the present and future  
The Commission organized on June 29 and  
the various pumping stations and reservoirs.  
of the Wissahickon valley, the valley of the  
Schuylkill River and the Delaware River above tide,  
Easton and the Water Gap. The report of the  
Councils before the close of the year and  
recommendations for the improvement of the present water  
for the Centennial year. For future supply the  
seemed to be reasonably practicable. Abstracts  
in the JOURNAL for November and Decem-

Board of Managers learned of the measures being  
Museum of Industrial Art similar to the South Kensington  
and gave the movement their endorsement. In December  
to the Institute to choose one of the trustees of  
the following year Mr. J. B. Knight, then  
was chosen to act in that capacity. For ten years  
the management of the Museum.

A committee was appointed at the meeting of the Institute held May 7.  
to give expression of the views  
of the waters of the Schuylkill River  
of the Girard Avenue bridge.  
of the JOURNAL for August.  
to the advantage which would  
of an intercepting  
from Manayunk or beyond,  
populated portions of the City

the Mayor appointed a



The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American Manufactures. 375 exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved, that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.



**WHEREAS**, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

**WHEREAS**, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

**WHEREAS**, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

**WHEREAS**, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

*Resolved*, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; **PROVIDED**, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

**WHEREAS**, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

**WHEREAS**, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

*Resolved*, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute, held September 19, at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

**WHEREAS**, It is the present established policy of the General Government to provide ample facilities for the water-borne commerce of the United States and to emancipate inter-state commerce from the obstructions imposed by tolls or restricted canals under private or corporate control,

**WHEREAS**, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

**WHEREAS**, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

**WHEREAS**, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six feet minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have



1923 Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924 September 17, 18, 19. Centenary celebration of the founding of The Franklin Institute and the Inauguration Exercises of the Bartol Research Foundation.

#### SPEAKERS AT THE CENTENARY CELEBRATION

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Street. Premiums were offered for perfumery and soaps, straw goods, chemicals, furs, saddlery and harness, leather, dental materials, surgical instruments.

1856, November 11 to 29 inclusive, twenty-fifth exhibition of American manufactures held in Dr. Jayne's building on Dock Street. Silver medals were awarded for specimens of rolled iron, hardware, stoves and heaters, cabinet ware, lamps and gas fixtures, silver ware and jewelry, cotton and woolen goods, chemicals, etc. 1226 exhibits.

1858, October 15 to November 13, twenty-sixth annual exhibition of American manufactures held in the State Armory Building and adjacent grounds (Sixteenth and Filbert Streets). Awards were made for musical instruments, books, stationery, printers' type and materials, boots and shoes, needlework, coachwork, dental materials, philosophical apparatus, glass and china, lamps and gas fixtures, machinery, etc. A special pamphlet report on the sewing machines deposited at this exhibition was published in 1859.

1863. The Guardians of the Poor requested the Institute to communicate to them the most efficient means of protecting the Alms House Buildings from lightning.

A subcommittee of the Committee on Science and the Arts, to whom the problem was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected and grounded. Detailed directions were given for making this installation.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulæ were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to Mechanical and Engineering Associations and Institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton, attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation



determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufacturers held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one, paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded.

1875. An ordinance passed by Councils June 5 requested the Mayor to appoint a Commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the Centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the JOURNAL for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum, London, and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1882. A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the JOURNAL for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the City as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a



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The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American Manufactures. 375 exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved, that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.





WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

*Resolved*, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

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## THURSDAY, SEPTEMBER 18TH

10.00 A.M. Sectional Meetings, the University of Pennsylvania.

1.30 P.M. Luncheon to Delegates and Guests, the Bellevue-Stratford.

2.30 P.M. to 6.00 P.M. Garden Party.

8.30 P.M. Open Meeting, the University Museum, Thirty-third and Spruce Streets. President Wm. C. L. Eglin, Sc.D., presiding, will introduce the Chairman of the evening, The Hon. William Cameron Sproul, LL.D. Address: "The Natural and Artificial Disintegration of Elements," by Professor Sir Ernest Rutherford, Kt., D.Sc., LL.D., Ph.D., D.Phys., F.R.S., Trinity College, Cambridge.

## FRIDAY, SEPTEMBER 19TH

9.30 A.M. Unveiling of Tablet at Bartol Research Foundation, 127 North Nineteenth Street, Mr. C. C. Tutwiler, presiding.

9.45 A.M. The Academy of Natural Sciences, Nineteenth and Race Streets. Address: "The Fifth Estate," by Arthur D. Little, Chem.D., Cambridge. Address: "Stimulation of Research and Invention," by Professor D. S. Jacobus, Dr. Eng., New York City.

11.30 A.M. Sectional Meetings, the University of Pennsylvania.

2.00 P.M. Luncheon to Delegates and Guests, the Bellevue-Stratford.

4.00 P.M. Convocation at the University of Pennsylvania, President Josiah Harmer Penniman, Ph.D., LL.D., L.H.D., presiding.

7.30 P.M. Banquet to Delegates and Guests, the Bellevue-Stratford.

Presentation of greetings from universities, colleges, learned and professional societies and industrial organizations.

## SECTIONAL MEETINGS

## WEDNESDAY, SEPTEMBER 17TH

2.30 P.M. The Hall of The Franklin Institute, 15 South Seventh Street. Rear Admiral W. A. Moffett, presiding.

Professor Joseph S. Ames, Ph.D., LL.D., The Johns Hopkins University, "Recent Developments in Aeronautics."

Major General Mason M. Patrick, Chief, United States Air Service, "Military Aircraft and Their Use in Warfare."

Major General George Owen Squier, Ph.D., United States War Department, "Electrical Communication for Military Purposes."

General John J. Carty, D.Sc., LL.D., American Telephone and Telegraph Company, "Progress in Telephony."

2.30 P.M. Lecture Room No. 216, Engineering Building, University of Pennsylvania. Dean Howard McClenahan, presiding.

Professor W. Lash Miller, Ph.D., University of Toronto, "Concentration and Polarization at the Cathode during Electrolysis of Solutions of Copper Salts."

Professor Julius Stieglitz, Ph.D., D.Sc., Ch.D., University of Chicago, "The Theory of Color Production in Organic and Inorganic Compounds."

Professor E. G. Coker, M.A., D.Sc., F.R.S., University College, London, "Photo-elasticity."



Professor Augustus Trowbridge, Ph.D., Princeton University, "Infra-red Spectroscopy."

F. W. Peek, General Electric Company, "Lightning."

Professor A. E. Kennelly, Sc.D., Harvard University and Massachusetts Institute of Technology, "The Measurement of Acoustic Impedance by the Aid of the Telephone Receiver."

10.00 A.M. University of Pennsylvania Museum. Doctor Samuel Insull, presiding.

E. W. Rice, Jr., Sc.D., D.Eng., Honorary Chairman, General Electric Company, "The Field of Research in Industrial Institutions."

Ralph Modjeski, Dr. Engr., Consulting Engineer, "Unusual Problems Encountered in the Design and Construction of Large Bridges."

Sir Charles Algernon Parsons, K.C.B., M.A., LL.D., D.Sc., F.R.S., Newcastle-on-Tyne, "Steam Turbines on Land and Sea."

William LeRoy Emmet, Sc.D., General Electric Company, "Mercury Boiler."

#### FRIDAY, SEPTEMBER 19TH

11.30 A.M. Harrison Chemical Laboratory, University of Pennsylvania. Professor Joseph S. Ames, presiding.

Professor Pieter Zeeman, Ph.D., Sc.D., University of Amsterdam, "Radiating Atoms in Magnetic Fields."

Professor John Sealy Edward Townsend, F.R.S., University of Oxford, "Motion of Electrons in Gases."

Professor W. F. G. Swann, D.Sc., University of Chicago, "The Origin of the Earth's Electric and Magnetic Phenomena."

J. Slepian, M.A., Ph.D., The Westinghouse Electric and Manufacturing Company, "Electric Discharges Between High Resistance Electrodes."

11.30 A.M. Lecture Room No. 216, Engineering Building, University of Pennsylvania. Doctor Arthur D. Little, presiding.

Director Charles L. Reese, Ph.D., Sc.D., E. I. du Pont de Neumours and Company, "Twenty-five Years' Progress in Explosives."

Professor F. G. Donnan, C.B.E., M.A., Ph.D., D.Sc., F.I.C., F.R.S., University College, London, "The Influence of J. Willard Gibbs on the Science of Physical Chemistry."

Provost Emeritus Edgar F. Smith, Ph.D., LL.D., L.H.D., Chem.D., Litt.D., M.D., University of Pennsylvania, "Early Science in Philadelphia."

11.30 A.M. Lecture Room No. 226, Engineering Building, University of Pennsylvania. Professor A. E. Outerbridge, Jr., presiding.

Professor C. H. Mathewson, Ph.D., Yale University, "The Trend in Physical Metallurgy."

George L. Kelley, Ph.D., Philadelphia, "The Restraint of Exaggerated Grain Growth in Critically Strained Metals."

Professor Bradley Stoughton, Lehigh University, "Magnetic Analysis of Steel."

T. D. Yensen, E.E., The Westinghouse Electric and Manufacturing Company, "Magnetic Properties of Fifty Per Cent. Iron, Fifty Per Cent. Nickel Alloys."



11.30 A.M. Lecture Room No. 314, Engineering Building, University of Pennsylvania. Major General George O. Squier, presiding.

Dean Harold Pender, Ph.D., Moore School of Electrical Engineering, University of Pennsylvania, "A New Type of Non-inductive High Resistance."

Professor A. A. Michelson, Ph.D., Sc.D., LL.D., The University of Chicago, "Velocity of Light."

Major General C. C. Williams, United States War Department, "Modern Ordnance."



hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.



SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Controller, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

## ARTICLE II.—*Members*

SECTION 1. Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. Members shall be classed as follows: Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, holders of Second Class stock.

SEC. 2. Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote or hold office. All other members shall be elected by the Board of Managers.

SEC. 3. Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year without payment of dues that number of persons, to be determined from time to time by the Board of Managers, whose annual dues if they were paying annual Resident Membership dues would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise: Provided, however, that the Board of Managers at any time may refund Five Thousand Dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

SEC. 4. Resident Life members, whose memberships shall not be transferable, shall pay the sum of Three Hundred Dollars (\$300) in any one year. Non-resident Life members shall be those who reside permanently at a distance of not less than twenty-five miles from Philadelphia and shall pay the sum of One Hundred Dollars (\$100) in any one year.

SEC. 5. Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of Three Hundred Dollars (\$300). A Contributing member shall have the privilege of nominating nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

SEC. 6. Resident members shall pay annual dues of Fifteen Dollars (\$15).



December. Each nomination paper must be signed by at least two members who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 5. On the date of the annual meeting, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

#### ARTICLE V.—*Duties of Officers*

SECTION 1. The President shall be the executive head of the Institute and as such shall have the general direction and supervision of all the affairs of the Institute. He shall preside at all meetings of the Institute and of the Board of Managers and shall be ex officio a member of all committees of the Institute and of the Board.

SEC. 2. The Vice-presidents shall exercise the duties of the President in his absence in the order of their seniority in office.

SEC. 3. The Secretary of the Institute shall be appointed by the Board of Managers and shall have charge and supervision, subject to the Board of Managers, of all the scientific activities of the Institute, other than those connected with the Bartol Research Foundation, its publications, museum and equipment. He shall keep the minutes of all meetings of the Institute and of the Board of Managers, and shall perform all the duties usually pertaining to the office of Secretary. He shall be ex officio a member of the Board of Managers, and of all standing committees of the Institute and of the Committee on Publications of the Board of Managers.

SEC. 4. The Treasurer shall receive all funds, payable to the Board of Managers, and all moneys collected for the Institute. He shall deposit all moneys received, in the name of the Institute, in such banks or trust companies as the Board of Managers may direct. He shall make no payments without the authority of the Board of Managers. He shall see that there are kept accurate accounts of the income and disbursements of the Institute, shall report current receipts and payments at each stated meeting of the Board of Managers, and shall make a detailed statement of the financial condition of the Institute as its annual meeting. He shall give bond to an amount, and with such surety, as the Board of Managers shall determine. In case of a vacancy in the office of Treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position until the next annual meeting.





City of Philadelphia to act as fiscal agent under the direction of the Committee. All purchases or sales of securities shall be reported monthly to the Board.

The Bartol Research Foundation Committee shall have charge of the provision, maintenance and operation of all laboratories and equipment concerning the Bartol Research Foundation. It shall engage the professional staff subject to the approval of the Board of Managers of the Institute and shall also engage and direct the operators and helpers employed in the work of the Foundation. It shall be composed of not more than twelve members, as follows: Five members of the Board of Managers, appointed by the President and approved by the Board; the President; the Director of the Bartol Research Laboratories; five members appointed by the President with the approval of the Board from the membership of the Institute not members of the Board.

The Director of the Bartol Research Laboratories shall report to the Bartol Research Foundation Committee. All other employees of the Foundation shall report to the Director. The Committee shall have full power to carry out the purposes of the Foundation. It shall make a report of its operation to the Board of Managers at each stated meeting.

#### ARTICLE VIII.—*Audits*

The accounts of the Treasurer and of the Fiscal Agent shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

#### ARTICLE IX.—*Committees of the Institute*

SECTION 1. There shall be the following standing committees of the Institute:

1. On Library.
2. On Meetings.
3. On Museum.
4. On Science and the Arts.

SEC. 2. The Committees on Library, Meetings and Museum shall consist of ten members each, appointed by the President at the first stated meeting after the annual election, to serve one year.

SEC. 3. The Committee on Library shall purchase books and other publications of a kind and character suitable to and consonant with the purpose of the Institute's library.

SEC. 4. The Committee on Meetings shall act with the Secretary of the Institute to secure for presentation before the Institute papers dealing authoritatively with subjects of import in the fields of physical science and engineering.

SEC. 5. The Committee on Science and the Arts shall consist of sixty members who shall serve three years. Twenty shall be elected each year by the Board of Managers at the first meeting after the annual election. The Committee shall investigate current discoveries, inventions and other achievements of workers in the physical sciences and their application in the mechanic and industrial arts with a view of affording such recognitions as lie within the power of the Institute to bestow.

SEC. 6. These committees shall organize and adopt rules and regulations suitable to their several activities, subject to the approval of the Board.



## AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute :

**The Franklin Medal.**  
**The Elliott Cresson Medal.**  
**The Howard N. Potts Medal.**  
**The Louis Edward Levy Medal.**  
**The George R. Henderson Medal.**  
**The Edward Longstreth Medal.**  
**The Certificate of Merit.**  
**The Boyden Premium.**

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

**The Franklin Medal (Gold Medal and Certificate).**—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

**The Elliott Cresson Medal (Gold Medal and Certificate).**—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

**The Howard N. Potts Medal (Gold Medal and Certificate).**—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

**The Louis E. Levy Medal (Gold Medal and Certificate).**—This medal is awarded to the author of a paper of especial merit, published in the JOURNAL OF THE FRANKLIN INSTITUTE, preference being given to one describing the author's experimental and theoretical researches in a subject of fundamental importance.



**The Elliott Cresson Medal.**—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscription: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

**The Howard N. Potts Medal.**—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."



"Any accumulation after providing the medals shall, after each period of five years, be added to the trust fund, and if this fund increases to double the original amount, one-half the net income may be used to provide the Henderson Medal for inventions in other fields than railway engineering.

"(Signed) VIRGINIA P. C. HENDERSON."

This was presented to the Board of Managers for consideration at their meeting on October 8, 1924, and was duly accepted.

**The Edward Longstreth Medal.**—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"*Resolved*, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"*Resolved*, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded 1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

**The Certificate of Merit.**—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"*Resolved*, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate





# REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

## ARTICLE I.—*Investigations*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. A request or a recommendation for the investigation of a subject shall be made in writing addressed to the Secretary who will submit it with full detailed information to the Sub-Committee on New Subjects and Preliminary Examination. If this Sub-Committee recommends it as a suitable subject for investigation to the Committee on Science and the Arts, and if this recommendation is adopted by the General Committee, the Secretary shall notify the applicant accordingly and furnish an application blank substantially like the form appended.

SEC. 4. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for investigation unless the subject for investigation be referred to the Committee by a vote of the Institute.

## ARTICLE II.—*Meetings of the Committee*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July, August and September.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meetings the Committee shall proceed in the following

### *Order of Business:*

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Approval of bills.
4. Reading of correspondence.
5. Report of sub-committee on new subjects and preliminary examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.



the current calendar year, and to report to the Committee not later than January of the following year, which, if any, of those papers deserve the award of the Louis Edward Levy Medal.

SEC. 3. There shall be appointed by the Chairman from the membership each February, a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

**ARTICLE V.—*Sub-Committees on Investigation of Applications***

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to all members thereof giving the names of the members of the sub-committee.

SEC. 4. No person who is interested in the issue shall be a member of the sub-committee on investigation.

SEC. 5. An applicant for investigation may withdraw his application at any time before final action by the Committee; which withdrawal shall be reported to the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.



SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

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*Secretary.*

SEC. 9. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of its descriptive portion may be furnished the applicant, who may make an explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 10. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of at the time of the first reading.

SEC. 11. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

#### ARTICLE VIII.—*Reconsideration*

SECTION 1. Upon the adoption of a report of a sub-committee, a motion for reconsideration must be made within the next three months. If such a motion is made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

#### ARTICLE IX.—*Advertisement of Recommendations*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal or the George R. Henderson Medal, publication shall be made in three successive issues of the JOURNAL OF THE FRANKLIN INSTITUTE, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within the time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement or manufacture.

SEC. 2. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal, the Louis Edward Levy Medal, the Edward Longstreth Medal or the Certificate of Merit, shall be conclusive without advertisement.



7. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled ..... the following data are requested for the information of the Committee on Science and the Arts:

- 1. What is the specific purpose of the invention?
- 2. What is the condition of the prior art in this regard?
- 3. What improvement is claimed to be effected by the invention?
- 4. How is the improvement effected?
- 5. What patents, if any, have been issued for this invention?
- 6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
- 7. Is the invention now in actual use?
- 8. If so, since when?
- 9. Where may it be seen in operation?
- 10. Are you prepared to submit drawings of the apparatus or device?
- 11. Are you prepared to submit a model of the apparatus or device?
- 12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
- 13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process, together with two copies of each of the United States patents issued to applicant, must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B

(Sub-committee Report Form)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....

Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of .....your sub-committee recommends

the award of ..... to ..... of .....

Respectfully submitted,

..... *Chairman.*

.....

.....

.....

Adopted at the Stated Meeting of ..... 19 .....



**YEAR BOOK OF**  
**FORM C**  
**(Institute Report Forms)**  
**THE FRANKLIN INSTITUTE**  
**OF THE**  
**STATE OF PENNSYLVANIA**  
**FOR THE**  
**PROMOTION OF THE MECHANIC ARTS**

**HALL OF THE INSTITUTE,**  
**Philadelphia, .....**

**S. & A. Case No. ....**

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....  
..... reports as follows:

.....

In consideration of the {  
discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... the Institute awards the.....

.....

to ..... of .....

....., *President.*

**[SEAL]**

..... *Secretary.*

**Countersigned** .....

*Chairman of the Committee on Science and the Arts.*



available, in book-form, notable lectures delivered before its members, has been very well received.

The report of the Committee on Meetings (Dr. Gellert Alleman, Chairman) contains a list of the lectures arranged by this Committee, showing that the meetings of the Institute during the past year have been very carefully arranged, and always selected with a view of presenting to the Institute members the latest and most authoritative information on the progress in science and industry. At the meeting held on the afternoon of May 21, 1924, The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership, were awarded to Sir Ernest Rutherford, F.R.S., Cavendish Professor of Physics, Cambridge University, Cambridge, England, in recognition of his "long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships." In Sir Ernest's absence, these awards were accepted in his behalf by H. G. Chilton, Esquire, C.M.G., Counsellor of the British Embassy, Washington. The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership, were also awarded to Dr. Edward Weston, of Newark, New Jersey, in recognition of his "discoveries and inventions in the field of electricity, immeasurably fruitful and fundamental, contributory to the establishment of the electric art." Unfortunately, Doctor Weston could not be present, on account of illness, and these honors were accepted for him by Dr. L. H. Baekeland, President of the American Chemical Society. In all, there were eight stated meetings of the Institute held on the third Wednesday of each month, from October to May inclusive, at which there was a total attendance of 1053. Sixteen other lectures were held during the same period, with a total attendance of 1894. This represents a very good average attendance at the meetings and lectures. Of course it must not be forgotten that the benefit reaches a still larger number through the medium of the Institute JOURNAL. All of the efforts of this Committee therefore are well worth while.

The Committee on Library (Mr. W. H. Fulweiler, Chairman) reports accessions for the year, of 831 bound volumes, 174 unbound volumes, and 1191 pamphlets, making a total increase for the year of 2196 publications. In addition to purchases these include gifts from members of the Institute and from other individuals. The Institute is also under obligation to various Government Departments, State and municipal officials, and to the numerous organizations who have, from time to time, supplied the Library with publications on technical subjects. To all of these the Institute is glad to record its appreciative thanks. The Committee also reports that the Library was maintained at its usual high standard by the binding of periodicals and the rebinding of old volumes, etc., and by continuing and increasing the number of exchanges of the JOURNAL for the publications of other scientific institutions. With its 82,941 volumes, 20,655 pamphlets, 2292 maps and charts, 1356 photographs and 784 original drawings and designs, our splendid Library is of priceless value not only to the members of the Institute, but to all scientists and engineers, and even the general public.

The Committee on Science and the Arts (Mr. George H. Benzon, Jr., Chairman) reports that final disposition was made of eighteen cases, eleven of which received awards. This Committee also reports two noteworthy gifts:



which such a man must be drawn is exceedingly limited, and it is of the utmost importance that the Director selected should be a man possessing such unusual scientific and personal attainments as will enable him to carry out the high aims contemplated in Mr. Bartol's generous bequest. Under the circumstances, the delay in starting the work will be appreciated. It is expected, however, that the selection of a Director will be made within a short time, possibly before this report is received, and it is felt that the delay will be more than compensated for in the selection of one, who is likely to put the Foundation in a favorable position with similar institutions.

In the meanwhile, all possible expense at the Foundation has been curtailed, and very considerable sums from income are being added to the principal of the bequest for future use.

The outstanding event of this past year was the Centenary Celebration of the Founding of the Institute and the Inauguration Exercises of the Bartol Research Foundation, held September 17th, 18th, and 19th, during which the Institute was honored by the presence of delegates from universities, scientific associations, and industrial organizations from this country and abroad. It was the most brilliant gathering of scientists that has probably ever been held in the United States. The purpose of this Celebration was to have a record of science in the year 1924. This was accomplished by the presentation of papers on chemistry, physics and engineering, by the world's leading scientists. The complete program of the Centenary Celebration giving the titles of the addresses and papers with the names of the speakers was published in the September issue of the JOURNAL. Monographs of the addresses and papers have since been issued. Many of these papers have been asked for by colleges and universities for the purpose of their employment as texts in various courses. A number of the recipients of these monographs have sent appreciative letters.

Some idea of the popular interest manifested in these publications may be gained by the fact that one address—that of Dr. Arthur D. Little, entitled "The Fifth Estate"—has been printed in eighteen different journals, the issues of which total approximately three million copies. Three volumes containing the complete proceedings of the Centenary Celebration are now in course of preparation, and will be available shortly.

Under the title, "Modern Views of Physical Science," Dr. Elwood Hendrick has described, in a most interesting manner, the details of the Centenary Celebration. Doctor Hendrick's book constitutes a permanent, but brief, record of the various meetings.

The Centenary Committee under the able chairmanship of Dr. Gellert Alleman, with Mr. Henry Howson as its Treasurer and Dr. Walton Clark, Mr. C. C. Tutwiler and your President as the other members, planned and carried out the program. The magnitude of the labors assumed by Doctor Alleman may be appreciated when it is stated that it involved correspondence with leading scientists all over the world, the reception and entertaining of the guests and delegates, the selection of appropriate lecture rooms and auditoriums, and careful attention to a host of other details. Our guests were unstinted in their praise of Doctor Alleman's efforts in providing for their every comfort. Mr. Henry Howson, as the Treasurer of the Committee, spent much time



An address appropriate to the occasion was made by Mr. C. C. Tutwiler, a Vice-President of the Institute and Chairman of the Bartol Research Foundation Committee.

An unusual feature of the Celebration was the Convocation held at the University of Pennsylvania on Friday afternoon, September 19th, when the President and Provost of the University, Dr. Josiah H. Penniman, assisted by the Vice-Provost, Dr. J. Hartley Merrick, conferred the Honorary Degree of Doctor of Science upon Sir William Henry Bragg, of the Royal Institution, London; Professor Charles Fabry, of the University of Paris; Sir Charles A. Parsons, of the Institution of Naval Architects, London; Dr. E. W. Rice, Jr., Honorary Chairman of the Board of Directors of the General Electric Company; Professor Pieter Zeeman, of the University of Amsterdam; and your President.

The Banquet held in the Ball Room of the Bellevue-Stratford on Friday evening, September 19th, was a gala occasion and a memorable conclusion to the Centenary Celebration.

The funds which made it possible for the Institute to carry out its Centenary Celebration in this noteworthy manner, were the result of liberal contributions from many industries and individuals. We are glad to record our thanks to these contributors for their generous assistance.

The proceedings of the Celebration received wide publicity in the daily newspapers and the technical press, and unquestionably this has more firmly established in the public mind an appreciation of the work of the Institute.

The outstanding success of the Centenary Celebration was due to the coöperation of the members, Board of Managers, and the Officers of the Institute, and to the whole-hearted assistance which we received from the various sources mentioned.

The official staff has undergone some changes. Dr. R. B. Owens resigned as Secretary of the Institute and Director of the Bartol Research Foundation, as recorded in the January, 1925, issue of the JOURNAL. Mr. T. R. Parrish, Actuary and Assistant to Doctor Owens, resigned to accept a position in the business world. Dr. George A. Hoadley was elected Acting Secretary and Editor of the JOURNAL. Mr. Alfred Rigling was elected Assistant Secretary and Assistant Editor of the JOURNAL, and also retains the position of Librarian. Mr. W. F. Jackson, Jr., was appointed to the office of Controller, formerly known as Actuary, and all of the accounting and allied work of the Institute, including that of the Bartol Research Foundation, has been placed in his charge.

It has been a real pleasure and privilege to me to serve the Institute as its President during the past year. In the work of this office, which otherwise might have become a serious burden, I have received the greatest measure of assistance and coöperation from the officers and the Board of Managers, from the Chairman and members of the Committees and from the staff of the Institute. I wish to record especially my appreciation of the invaluable aid and counsel rendered to me by my predecessor, Dr. Walton Clark. His long experience as the President of the Institute for seventeen years, he has unreservedly placed at my disposal at all times. This intimate association with Doctor Clark has been most agreeable and inspiring to me.

Another century of opportunity now lies before the Institute. With the





An address appropriate to the occasion was made by Mr. C. C. Tutwiler, a Vice-President of the Institute and Chairman of the Bartol Research Foundation Committee.

An unusual feature of the Celebration was the Convocation held at the University of Pennsylvania on Friday afternoon, September 19th, when the President and Provost of the University, Dr. Josiah H. Penniman, assisted by the Vice-Provost, Dr. J. Hartley Merrick, conferred the Honorary Degree of Doctor of Science upon Sir William Henry Bragg, of the Royal Institution, London; Professor Charles Fabry, of the University of Paris; Sir Charles A. Parsons, of the Institution of Naval Architects, London; Dr. E. W. Rice, Jr., Honorary Chairman of the Board of Directors of the General Electric Company; Professor Pieter Zeeman, of the University of Amsterdam; and your President.

The Banquet held in the Ball Room of the Bellevue-Stratford on Friday evening, September 19th, was a gala occasion and a memorable conclusion to the Centenary Celebration.

The funds which made it possible for the Institute to carry out its Centenary Celebration in this noteworthy manner, were the result of liberal contributions from many industries and individuals. We are glad to record our thanks to these contributors for their generous assistance.

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Institute is also under obligation to various government departments, state and municipal officials and to the numerous organizations who have from time to time supplied the library with publications on technical subjects.

The contents of the library on September 30, 1924, were:

Volumes, bound and unbound .....	82,940
Pamphlets .....	20,655
Maps and Charts .....	2,292
Photographs .....	1,356
Original Drawings and Designs .....	784

*Binding:*

During the year the following work was done by the binders:

Recent volumes of periodicals .....	383
Patent specifications .....	22
350 pamphlets bound .....	24
Volumes charged to the Ware Fund .....	4
Old volumes bound .....	66
Old volumes rebound .....	1

*Magazines and other periodical publications:*

5650 copies of the JOURNAL were distributed for exchange purposes.

26 new exchanges were added to the mailing list and 13 were removed.

The total number of exchanges on September 30 was 504.

The subscriptions totalled 192.

The number of publications received by gift was 103, making the total periodical publications received by the library 799.

No changes have occurred in the library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,  
*Chairman.*

PHILADELPHIA, January 14, 1925.

## REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

*To the President and Members of The Franklin Institute:*

The following models, apparatus and specimens have been added to the Institute's collection since the date of the last report:

Four-Light Series Brush Arc Generator No. 36, presented to the Institute by the Philadelphia Electrical and Manufacturing Company through Mr. C. L. Bundy, Secretary and Treasurer.

Weston Dynamo, 1876, Brush Dynamo (early form) and Dynamo without name-plate, given by Mr. Julius Boekel.

A collection of switches, meters and other electrical apparatus presented by Mr. J. P. Manypenny, President of the Engineering Equipment Company, Philadelphia.

Medallions of George Washington, Benjamin Franklin and the Prince of Wales, cast in Hadfield manganese steel, presented by Sir Robert Hadfield.



ments in California and Chili. References to volcanic phenomena were largely confined to those recently exhibited by Etna, of which a number of colored slides were shown portraying various stages of the several eruptions. At this meeting the Elliott Cresson Medal was awarded to Raymond D. Johnson for his invention of the "Johnson Hydraulic Valve."

November 21, 1923: Rear Admiral William A. Moffett, U. S. N., Chief, Bureau of Aeronautics, Navy Department, Washington, D. C., presented a paper on "ZR-1, the First Helium Filled Dirigible," in which he referred to the cessation of airship building abroad and to the reviving of this art by the American Navy, which constructed the ZR-1, in which is used helium, a non-combustible and non-explosive gas. By use of lantern slides, he pointed out the main structural features of this airship, the arrangement of the gas bags and the location of the motors. He said that naval constructors had turned their hands to airship building and were pioneering for a new industry and a new commercial era in aeronautics. He further referred to the airship as a recent factor in world commerce, and by use of charts pointed out possible airship routes which would greatly aid in speeding up communications and cutting down distances. He also emphasized the importance and value of the airship as a naval unit. At this meeting were awarded the Elliott Cresson Medal to Albert Kingsbury for his invention of the "Kingsbury Thrust Bearing," and the Edward Longstreth Medal to Harry S. Parks for his invention of the "Pneumercator Tank and Draft Gauge."

December 19, 1923: W. F. G. Swann, A.R.C.S., D.Sc., Professor of Physics, University of Chicago, Chicago, Illinois, presented a paper on "The Structure of the Atom," describing the fundamental entities and radiations associated with the modern theory of the atom. He discussed the electron, the proton, and the radioactive radiations; and illustrated his remarks by lantern slides. He also discussed the bearing of spectral and radioactive phenomena on the theory of atomic structure, and touched on the work of Thomson, Rutherford, Aston, Bohr and Sommerfeld in connection with the development of this theory, and spoke of the part played by the theory of relativity in the fine structure of spectral lines. This paper of Doctor Swann's has been published in the March, 1924, issue of the JOURNAL.

January 16, 1924: Charles H. Herty, Ph.D., D.Sc., President, Synthetic Organic Chemical Manufacturers' Association, New York City, presented a paper on "The Coal-Tar Industries of the United States." He pointed out that the United States possesses an abundance of raw material for the development of the coal-tar industries, but prior to the world war economic conditions were such that a large proportion of the coal-tar was wasted or consumed in the raw state. War conditions brought about a blockade against German coal-tar chemicals, and this in turn led to the development of a coal-tar chemical industry in this country. Dyestuffs, medicinals, high explosives, photographic chemicals, synthetic flavoring extracts, perfumes and tanning materials are all finished products emanating from coal-tar. During the past five years the coal-tar chemical industry has grown to an annual production of eighty-eight million pounds, of a total value of fifty-four million dollars, as shown by the United States Tariff Commission annual census. Doctor Herty showed that it is essential that the independence of this country in this line



comprehensible to those not conversant with the matter. His communication, which was illustrated by lantern slides, was published in the July, 1924, issue of the JOURNAL. At this meeting Honorary Membership was conferred on Dr. Charles A. Coffin, who was presented by Dr. Samuel Insull, a Life Member of the Institute.

May 21, 1924: Mr. W. C. L. Eglin, President, in the chair, recognized Dr. Joseph S. Ames, Dean, The Johns Hopkins University, Baltimore, Maryland, who made a statement relative to the work of Sir Ernest Rutherford, F.R.S., Cavendish Professor of Physics, Cambridge University, Cambridge, England, recently awarded the Franklin Medal in recognition of "long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships." H. G. Chilton, Esquire, C.M.G., Counsellor of the British Embassy, Washington, D. C., representing His Britannic Majesty's Government, was then presented to the Chairman and received from him the Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership in the Institute, awarded to Sir Ernest Rutherford. Mr. Chilton expressed for his Government its appreciation of the high honor conferred upon his distinguished countryman. Dr. Frank Sprague, of New York City, was then recognized, and described the work of Dr. Edward Weston, of Newark, New Jersey, who had been awarded the Franklin Medal in recognition of "discoveries and inventions in the field of electricity immeasurably fruitful and fundamentally contributory to the establishment of the electric art." Due to the illness of Doctor Weston, Dr. L. H. Baekeland, President of the American Chemical Society, was presented to the Chairman and received from him the Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership in the Institute for Doctor Weston. The paper, "Early Days in Radio-activity," prepared for presentation at this meeting by Sir Ernest Rutherford, was read by Dr. Joseph S. Ames, and has since been published in the September, 1924, issue of the JOURNAL.

At these Stated Meetings of the Institute there was a total attendance of 1053.

Sixteen other meetings were held during the year in the hall of the Institute. The following is a list of dates and speakers with titles and synopses of their communications:

October 25, 1923: John A. Miller, Ph.D., Professor of Mathematics and Astronomy, Swarthmore College, Swarthmore, Pennsylvania, presented a paper on "Solar Eclipse of 1923," giving a general statement of the problems attacked during the eclipse: the study of the form of the corona; a study of the chemical composition of the corona; a study of the motion of the corona; and the testing of the Einstein theory. He described the instruments used for the various problems, and spoke of the Swarthmore program of observations at Yerbanis, Mexico. The paper was illustrated by lantern slides.

November 1, 1923: Howard T. Barnes, D.Sc., F.R.S., Former Professor of Physics, McGill University, Montreal, Canada, presented a communication on "Ice Formation," calling attention to the delicate poising of the forces of Nature as illustrated by the freezing of water in lakes and rivers. He contrasted the melting temperature of ice with the freezing temperature of water, and spoke of surface ice, its rate of growth as influenced by atmospheric





or alkalinity, but does not give the amount of active hydrogen or hydroxyl developed by the ionizing action of the solvent. He said that this fact does not interfere in the ordinary operations of the laboratory, but in studies of the action of liquids upon living tissues, the amount of acid or alkali ionized is of great importance. The problems of determining the degree of ionization and interpreting the results have been extensively studied. The earlier views of the nature and constitution of acids and alkalies were briefly summarized, after which were set forth some of the salient features of the modern investigations into the relation of ionization to the physiological processes of plants and animals. The paper appeared in the June, 1924, issue of the JOURNAL.

January 10, 1924: L. B. Tuckerman, A.B., Bureau of Standards, Department of Commerce, Washington, D. C., presented a paper on "Materials and Structural Testing," in which he discussed the function of the materials and structural testing laboratory in the development of structural engineering. The paper, which was illustrated by lantern slides, dealt with the following topics:

1. Tests of materials and their significance in determining the value of materials in use.

2. The problem of new materials.

3. Structural testing.

- Full scale tests.

- Model tests.

- Optical stress analysis.

4. Service tests.

5. Correlation of the results of materials, structural and service tests.

January 24, 1924: L. T. Troland, Ph.D., Professor of Psychology, Harvard University, Cambridge, Massachusetts, spoke on "The Interrelations of Modern Physics and Modern Psychology." The paper, which was illustrated by lantern slides, was later published in the April, 1924, issue of the JOURNAL. Doctor Troland said that the psychological sciences have in general been delegated to deal with those facts of experience which are not considered by the physical sciences. Thus the very conception of the psychical depends reciprocally upon that of the physical, and must change with the latter. He discussed the present status of this relationship in the light of modern physical ideas. Another phase of the topic consists in the relations which are found experimentally to exist between psychological and physical phenomena, and the speaker discussed some specific modern problems in this field with the purpose of making clear the general nature of the psychophysical relationship—the interdependency of "body and mind"—as it must be formulated in terms of the latest conceptions of physics. Finally, he gave brief consideration to the more philosophical problem as to the manner in which the interrelationships of physical and psychical are to be explained.

January 31, 1924: Wheeler P. Davey, Ph.D., Research Laboratory, General Electric Company, Schenectady, New York, presented a paper on "Radiation" since published in the April and May issues of the JOURNAL. Since those radiations which are commonly called "wave motions" cannot be affected while traversing empty space, our whole knowledge of them is based on experiments which deal (a) with the material substances in the source of the "waves," or (b) with the material substances which may be interposed in



pany, Incorporated, New York City, spoke on "Ferromagnetism and Its Dependence upon Chemical, Mechanical and Thermal Conditions." He showed how recent theoretical and experimental studies upon the magnetic properties of atoms and ions in gases and liquids have emphasized the need for more searching study into the ferromagnetic condition of atoms in solid metals and alloys, and how improvements in ferromagnetic materials for particular purposes have supplied opportunities for such study. New instruments of research have been devised for the examination of samples subjected to mechanical and thermal control prior to or during the observations. Doctor McKeehan also said that simultaneous variations of other than magnetic properties afford clues to the nature of the atomic or sub-atomic processes in magnetization. His paper, which was illustrated by lantern slides, has since appeared in the May and June, 1924, issues of the JOURNAL.

March 6, 1924: O. Maass, Ph.D., Professor of Physical Chemistry, McGill University, Montreal, P. Q., Canada, presented a paper illustrated by lantern slides on "Molecular Attraction and Molecular Combination." He said that the experimental determination of physical properties, such as gas density, melting point, surface tension, etc., has given an insight into the relative magnitudes of attractions existing between molecules; and that the actual isolation of molecular compounds and the measurement of the rates of chemical reactions are also available for investigation of molecular attraction. The constituents of oxonium compounds and the unsaturated hydrocarbons in conjunction with the halogen hydrides have been used for an investigation of this kind, and Doctor Maass discussed the results in connection with prevailing views of electron distribution in molecules. This paper appeared in the August, 1924, issue of the JOURNAL.

March 13, 1924: Charles H. Paul, C.E., Chief Engineer, The Miami Conservancy District, Dayton, Ohio, at a joint meeting with the Philadelphia Section, American Society of Civil Engineers, presented a communication on "Control of River Flood Conditions with Special Reference to the Miami Conservancy District of Ohio." He discussed the problems involved in the control of river floods, and described some methods used in this country and abroad, giving a detailed explanation of the causes and effects of the 1913 flood in the Miami Valley. He showed the manner in which data were collected and studies made preliminary to design, and followed this by an outline of the design and structures of the Miami Conservancy District and the manner in which they were constructed. These works include five large earth dams constructed by the hydraulic method, and a series of river channel and levee improvements in each of the cities of the district. The paper was illustrated by lantern slides, and appeared in the August, 1924, issue of the JOURNAL.

March 27, 1924: John Johnston, D.Sc., Sterling Professor of Chemistry, Yale University, New Haven, Connecticut, spoke on "Solubility Relations of Organic Compounds." The paper, which was illustrated by lantern slides, showed that systematic investigation of solubility of organic compounds, and in particular of isomeric and other closely related substances, is yielding results of considerable significance. In the first place, it offers a means of analyzing mixtures of isomeric substances which are not separable by purely chemical



## REPORT OF THE COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

*To the Board of Managers of The Franklin Institute:*

During the fiscal year ending September 30, 1924, seventy-four new members were enrolled in all classes of membership; resignations were received and accepted from twenty-nine members; and deaths of twenty-one members were recorded.

The detail as to elections, resignations, and deaths for the two years ending September 30, 1924, is as follows:

ELECTIONS:	1922-23	1923-24
Resident Members .....	32	37
Non-Resident Members .....	21	33
Associate Members .....	4	3
Honorary Members .....	0	0
Corresponding Members .....	0	0
Life Members .....	2	1
Second Class Stock .....	1	0
	<u>60</u>	<u>74</u>
RESIGNATIONS:		
Resident Members .....	9	13
Non-Resident Members .....	18	15
Associate Members .....	3	1
Second Class Stock .....	0	0
	<u>30</u>	<u>29</u>
DEATHS:		
Resident Members .....	11	8
Non-Resident Members .....	10	7
Life Members .....	3	4
Honorary Members .....	1	1
Associate Members .....	1	0
Second Class Stock .....	1	0
Corresponding Members .....	0	1
	<u>27</u>	<u>21</u>
SUMMARY:		
Elections .....	64	74
Resignations .....	30	29
Dropped for non-payment of dues .....	23	15
Deaths .....	27	21
Net increase in membership .....		27

Membership of the Institute by Classes, September 30, 1924.

Resident Members .....	538
Non-Resident Members .....	563
Life Members .....	199
Honorary Members .....	24
Associate Members .....	28
Second Class Stock Members .....	24
Corresponding Members .....	2
Total .....	1378

An increase of twenty-seven was recorded in the membership of the Institute for the year ending September 30, 1924.

Respectfully submitted,

R. W. LESLEY,  
*Chairman.*

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON STOCKS AND  
FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the Board of Managers of The Franklin Institute:

The Committee presents the following statement:

PROPERTY AND FUNDS

Building and Land, 13-17 South Seventh Street....	\$60,000.00		
Library .....	100,000.00		\$160,000.00
		<i>Unexpended</i>	
	<i>Principal</i>	<i>Income</i>	
Funds held by Board of Trustees ....	\$623,027.88	\$2,537.48	
Funds held by Board of Managers....	169.44		
Franklin Institute Building Fund....	554,582.60		
Elliott Cresson Medal Fund.....	3,000.00	1,017.88	
Franklin Fund and Building Committee	16,826.21		
Total Funds .....	\$1,197,606.13	\$3,555.36	\$1,201,161.49
Grand Total .....			\$1,361,161.49

LIABILITIES

Certificates of Stock .....	\$28,804.00
Bills Payable .....	33,000.00
Vouchers Payable .....	2,762.46
Unearned Income .....	67.50
	<u>\$64,633.96</u>

## INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED SEPTEMBER 30, 1924

*Income:*

Dues—Resident .....	\$7,470.00	
Non-Resident .....	2,735.00	
Second Class Stock.....	252.00	
Associate .....	82.50	\$10,539.50
Initiation Fees .....		140.00
H. Belfield Memorial Fund .....		268.82
James H. Cresson Memorial Fund .....		2,302.31
General Endowment Fund .....		19,265.23
John H. Wahl Fund .....		4,578.59
Lewis S. Ware Library Fund .....		600.00
Estate of John Turner .....		156.49
Estate of Robert Wright .....		2,144.65
Publications—Subscriptions and Sales .....	\$3,481.50	
Advertising .....	4,413.37	7,894.87
“Physics of the Air” .....		250.00
Miscellaneous Income and Expense .....		704.16
Total .....		\$48,844.62

## EXPENSES

Building—Wages .....	\$1,893.85	
Repairs and Maintenance .....	2,085.30	
Taxes, Water Rent and Insurance .....	96.89	
Heat, Light and Power .....	936.22	
Miscellaneous Supplies and Expense .....	370.86	\$5,383.12
Instruction—Salaries and Annuities .....	\$250.00	
Miscellaneous Expense .....	148.92	398.92
Library—Salaries .....	9,346.95	
Books and Periodicals .....	1,673.32	
Binding .....	1,150.00	
Miscellaneous Expense .....	490.61	12,660.88
Meetings .....		1,398.64
Office and General—Salaries .....	\$14,998.29	
Office Expense .....	2,102.62	
General Expense .....	1,578.86	
Auditor and Treasurer .....	918.87	19,598.74
Publications—Printing .....	\$14,723.07	
Illustrating .....	3,259.68	
Miscellaneous Expense .....	815.98	
Year Book .....	822.01	
Reprints .....	1,064.41	20,685.15





## YEAR BOOK OF

The expenses of the Committee for the year are as follows:

Printing .....	\$14,723.07
Illustrations .....	3,259.68
Year Book .....	822.01
Miscellaneous Expense .....	815.98
Total .....	<u>\$19,620.74</u>

The net expenses are less than this amount, the receipts being:

For Advertisements .....	\$4,413.37
For JOURNAL Subscriptions .....	3,481.50
Total Receipts .....	<u>\$7,894.87</u>
Making the net cost .....	\$11,725.87

Respectfully submitted,

GEORGE D. ROSENGARTEN,

PHILADELPHIA, January 14, 1925.

*Chairman.*

## REPORT OF COMMITTEE ON ENDOWMENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

*To the Board of Managers of The Franklin Institute:*

Your Committee has received the two following Endowments this year:

Louis Edward Levy Medal Fund .....	\$2,500.00
George R. Henderson Medal Fund .....	2,500.00

Respectfully submitted,

G. H. CLAMER,

PHILADELPHIA, January 14, 1925.

*Chairman.*

## REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FROM OCTOBER 1, 1923, TO JANUARY 31, 1925

*To the President and Members of The Franklin Institute:*

In order to have the yearly report of the Chairman cover the exact months of his Chairmanship, this report includes a record of the work of the Committee on Science and the Arts, from October 1, 1923, to January 31, 1925. The year 1924 was the ninetieth in which the Committee has rendered service to the Institute. During the period which this report covers, investigation and final disposition of eighteen cases were made, and there are now pending seventeen cases.

The appendix of this report gives the name of the inventor, the name of the invention and the award made in each case.

Eleven of the eighteen cases investigated received awards, one was tabled, one was withdrawn and five were dismissed without prejudice.

The standing Sub-Committee on The Franklin Medal and the standing



supplied at the Nineteenth Street buildings provided with a projection lantern. The first meeting held in this room was on February 6, 1924. Dr. Wm. C. L. Eglin was present at this meeting and spoke in words of highest praise of the valuable work done each year by the Committee on Science and the Arts.

On account of the Celebration of the Centenary of the Institute on the 17th, 18th. and 19th of September and the necessary work of preparation, the September meeting of the Committee was omitted.

A detailed statement of the Committee's work during the period which this report covers is appended.

Respectfully submitted,

GEO. H. BENZON, JR.,  
*Chairman.*

APPENDIX

STATEMENT OF THE COMMITTEE'S OPERATION FROM OCTOBER 1, 1923,  
TO JANUARY 31, 1925

Cases pending October 1, 1923 .....	18
Applications received to January 31, 1925 .....	11
Special Reports .....	6
	<hr/>
	35
Disposed of to January 31, 1925 .....	18
Leaving pending .....	17

AWARDS MADE

Franklin Medal Awards .....	2
Louis Edward Levy Awards .....	1
Howard N. Potts Awards .....	2
Edward Longstreth Awards .....	6
	<hr/>
	11



# **AWARDS**

**1835-1925**

## **FRANKLIN MEDAL AWARDS**

**1915-1925**

**ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.**

"In recognition of his notable contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

**CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.**

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

**DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.**

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

**EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.**

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

**FABRY, CHARLES, D.Sc.**

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

**FERRIÉ, AUGUSTE GUSTAVE, GENERAL**

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization



CRESSON MEDAL AWARDS

1856-1925

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CLEVELAND MEDAL AWARDS

CARROLL, EDWARD.

Roll and Kroll Copper.—1878.

CHARLTON, J.

Steel Casting.—1876.

CHAMBER, C. H.

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"Measuring Ocean Depths by Acoustical Methods" (Paper).—1925.

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Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

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Austin Organ.—1917.

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1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—  
1903.

AUSTIN, JOHN T.

Austin Organ.—1917.



## LONGSTRETH MEDAL AWARDS

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials"  
(Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BBADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BRANDT, EDWARD J.

Automatic Cashier.—1922.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

BRISTOL, W. H.

Recording Pressure Gauge.—1894.

BROWN, HAROLD P., AND EDISON, THOMAS A.

Rail Bonds and Electrical Contacts.—1899.

CAFFREY, C. S., AND COMPANY.

Improvement in Carriages and Wagons.—1900.

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

"Continuous Electric Oscillations" (Paper).—1913.

CHANCE, E. M.

"Pathogenic Mine Atmospheres" (Paper).—1912.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Ventilating Stove.—1894.

COLLINS, FRANK W., AND CLARK, WM. H.

Ventilating Stove.—1894.

## LONGSTRETH MEDAL AWARDS

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete"  
(Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

"Researches on the Corrosion of Iron and Steel" (Paper).—1908.

DANA, A. S., KENNELLY, A. E., AND ACHARD, F. H.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—  
1917.

DESHLER, CHARLES, AND MCALLISTER, EDWARD J.

Portable Photometer.—1900.

DEVÖE, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

EBERHARDT, HENRY F., AND ULRICH, F. L.

Radial Gang Cutter.—1904.

EDDISON, WILLIAM BARTON.

Jet Entraining Apparatus.—1921.

EDISON, THOMAS A., AND BROWN, HAROLD P.

Rail Bonds and Electrical Contacts.—1899.

EDWARDS, LEVI TALBOT.

Compound Air-Lift System.—1918.

ELLIOTT, WILLIAM SWAN.

Process and Apparatus for the Deaeration of Liquids.—1924.

ELLIS, CARLETON.

Paint and Varnish Remover.—1916.

EVE, A. S.

"Modern Views on the Constitution of the Atom" (Paper).—1916.

FAY, C. N., SHOLES, Z. G., AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

## LONGSTRETH MEDAL AWARDS

FOLLETT, W. I.

Time Stamp.—1906.

FOLMER AND SCHWING MFG. COMPANY.

Graflex Cameras.—1905.

FORBES, J. S., AND ADAMS, W. G.

Stop Valve for Radiators.—1893.

FREAS, SAMUEL T.

“Interlocking” Tooth Saw.—1922.

FRICK, FRED.

Electric Program Clock.—1899.

FULLER, G. W.

“Biochemical and Engineering Aspects of Sanitary Water Supply”  
(Paper).—1916.

GOLDMAN, HENRY.

Arithmachine.—1901.

GOODYEAR, CHARLES.

Projection Lantern.—1895.

GRANBERY, J. H.

Stadia Rod.—1909.

HARTNESS, JAMES.

Screw Thread Comparator.—1922.

HEILPRIN, A.

Improved Ventilating Car Window.—1897.

HENNING, G. C.

Pocket Recorder for Tests of Materials.—1899.

HEPBURN, J. S.

“Chemistry of Sugar” (Paper).—1911.

HERR, H. T.

“Development of Steam Turbines” (Paper).—1914.

HICKS, THOMAS WILLING.

“Once-Over” Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J. AND COMPANY.

Self-Pronouncing Bibles.—1900.



## LONGSTRETH MEDAL AWARDS

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; AND HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MCBRIDE, THOMAS C.

Locomotive Feed Water Heater.—1924.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

## LONGSTRETH MEDAL AWARDS

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MILEY, HENRY M., AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

“A 32-Element Harmonic Synthesizer” (Paper).—1917.

MOORE, RICHARD B.

“Biography of Sir William Ramsay” (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NACHOD, CARL P.

Electric Railway Signal System.—1924.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHRUP, E. F.

“Vortex Motion in Liquids” (Paper).—1912.

PANTASOTE LEATHER COMPANY.

“Pantasote.”—1896.

PARKE, HARRY S.,

Pneumercator Tank and Draft Gauge.—1923.

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W. VON.

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

“Portland Cement” (Paper).—1917.

RECKLINGHAUSEN, M. VON.

“Ultra-Violet Rays” (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

## LONGSTRETH MEDAL AWARDS

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1919.

SCHMIDT, MAX, AND SIEBER, JOSEPH.

Movable Sidewalk.—1894.

SCHMIDT, HENRY J., AND BONNELL, RUSSELL.

Gate Valves.—1901.

SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.

Portable Brinell Meter.—1917.

SCHREINER, O., AND LATHROP, E.

"Organic Constituents in Soils" (Paper).—1912.

SCRIPTURE, E. W.

Color Sense Tester.—1903.

SEITZ, HENRY JEROME.

Coal Loading and Screening Machines.—1904.

SHARPLES, SPECIALTY COMPANY.

Super-Centrifuge.—1916.

SHAW, H. M.

Lightning Arrester.—1904.

SHEEN, MILTON ROY.

Expansion Machine for Tunnel Construction.—1924.

SHELLENBACH, WILLIAM L.

Variable Speed Countershaft.—1903.

SHOLES, Z. K.; FAY, C. N.; AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

SIEBER, JOSEPH, AND SCHMIDT, MAX E.

Movable Sidewalk.—1894.





## LONGSTRETH MEDAL AWARDS

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

“The Electric Strength of Air and Methods of Measuring High Voltage”  
(Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

“The Annealing of Glass” (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

“Locomotive Superheaters” (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Sets.—1918.

ZIMMERMANN, WILLIAM F.

Hob for Worm Gears.—1924.

## CERTIFICATE OF MERIT AWARDS

1885-1925

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GRAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

## CERTIFICATE OF MERIT AWARDS

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; AND ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

## CERTIFICATE OF MERIT AWARDS

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

REAGAN, JAMES.

Improved Gates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

## CERTIFICATE OF MERIT AWARDS

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; AND GENERAL  
ELECTRIC COMPANY.

Magnetite Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the  
Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-Off for Slide Valve Engines.—1889.



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McCLENAHAN, HOWARD, 1925-	WAHL, WILLIAM H., 1871-1874, 1882-1908

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ALLISON, WILLIAM C., 1863	





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- EMERSON, G., 1828  
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 EVANS, OWEN, 1844-1857  
 FERGUSON, ALEXANDER, 1831-1841  
 FLETCHER, THOMAS, 1826-1827  
 FLING, WILLIAM B., 1842  
 FORSTALL, WALTON, 1908-1925  
 FOX, GEORGE, 1828-1830  
 FRALEY, FREDERICK, 1829, 1848-1854  
 FRANKLIN, BENJAMIN, 1917-1919  
 FRAZER, JOHN F., 1844, 1865-1866  
 FRAZER, PERSIFOR, 1880-1891, 1903-1909  
 FRAZIER, GEORGE H., 1898  
 FRENCH, HOWARD B., 1900  
 FRY, WILLIAM, 1825  
 GARDINER, JOHN, JR., 1864  
 GARRIGUES, ISAAC B., 1825-1829, 1831-1836  
 GARRISON, F. LYNWOOD, 1890-1895, 1897-1903  
 GAWTHROP, HENRY, 1896-1898  
 GIBBS, ALFRED W., 1915-1922  
 GIBSON, J. HOWARD, 1893-1894  
 GIBSON, JOHN J., 1912-1915  
 GILDER, JOHN, 1838-1841  
 GILPIN, THOMAS, 1824  
 GOBRECHT, CHRISTIAN, 1828-1830  
 GOLDSMITH, E., 1908-1916  
 GOODSPEED, ARTHUR W., 1925-  
 GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881  
 GRAHAM, HOWARD S., 1920-1921  
 GREBLE, EDWIN, 1841-1863  
 GREENE, STEPHEN, 1898-1908  
 GRIES, JOHN M., 1858-1862  
 GRIFFITH, R. EGGLESFIELD, 1870-1871  
 GRIFFITH, ROBERT E., 1827  
 GROVES, DANIEL, 1824-1827  
 HALL, CLARENCE A., 1922-  
 HAND, JAMES C., 1845-1846  
 HANSELL, WILLIAM S., 1827  
 HARDING, GEORGE, 1864-1865  
 HARKER, JOSHUA G., 1831-1836  
 HARPER, JAMES, 1824-1826  
 HARRIS, WILLIAM, 1860-1863  
 HARRISON, ALFRED C., 1895-  
 HARRISON, C. LELAND, 1899-1902  
 HARRISON, JOHN, 1824-1829  
 HARRISON, JOSEPH, JR., 1854, 1856-1859  
 HART, SAMUEL, 1865-1870  
 HAVILAND, JOHN, 1824-1826  
 HAYS, ISAAC, 1840-1841  
 HAYWARD, NATHAN, 1917-  
 HELLER, CHARLES S., 1879-1880  
 HELME, WILLIAM, 1869-1888  
 HENDERSON, GEORGE R., 1915-1921  
 HERSE, GEORGE P., 1851  
 HEXAMER, CHARLES A., 1904-1925  
 HEYL, HENRY R., 1879-1895, 1898-1909  
 HOADLEY, GEORGE A., 1911-  
 HORN, HENRY, 1824  
 HORSTMANN, WILLIAM J., 1865-1868  
 HOUSTON, EDWIN J., 1874-1897  
 HOWARD, GEORGE C., 1855-1858  
 HOWE, HERBERT M., 1898-1900  
 HOWSON, CHARLES HENRY, 1903-1907  
 HOWSON, HENRY, 1898-1903  
 HUFTY, SAMUEL, 1834-1850  
 HUMPHREYS, SAMUEL, 1826  
 HUNTER, JAMES, 1864  
 HUTCHINSON, CHARLES H., 1888-1890  
 HUTCHINSON, JAMES, 1841-1842  
 HUTCHINSON, JOSEPH, 1860-1863  
 JAYNE, HARRY W., 1891-1910  
 JENNINGS, W. N., 1896  
 JOHNSON, LAWRENCE, 1855-1859

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- JONES, THOMAS P., 1826  
 JONES, WASHINGTON, 1859-1895, 1897-1900  
 KATEZ, I., 1824  
 KEATING, WILLIAM H., 1824-1826, 1830-1840  
 KELLER, HARRY F., 1914-1924  
 KELLY, HENRY H., 1851  
 KING, ROBERT P., 1851  
 KIRK, CHARLES H., 1830  
 KIRKPATRICK, GEORGE E., 1911-1914  
 KLUMPP, JOHN BARTLEMAN, 1923  
 KNEASS, WILLIAM, 1825  
 KNIGHT, DANIEL R., 1845  
 KRUMBHAAR, ALEXANDER, 1898-1911  
 KUHN, C. HARTMAN, 1896-1905  
 LAMBERT, WM. H., 1906  
 LESLEY, ROBERT W., 1913-  
 LE VAN, W. BARNET, 1864-1876  
 LEVY, LOUIS E., 1903-1915  
 LEWIS, ENOCH, 1868-1894  
 LEWIS, HARVEY, 1824-1827  
 LEWIS, MORDECAI D., 1828-1836  
 LINDSAY, JOHN, 1843  
 LINDSAY, ROBERT, 1834-1836  
 LINNARD, JAMES M., 1836-1838  
 LINVILLE, J. HAYES, 1868  
 LONGSTRETH, CHARLES, 1903-1907  
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897  
 LOUD, THOMAS, 1829-1831  
 LOVE, WILLIAM H., 1859  
 LUCAS, JOHN, 1888-1894  
 LUKENS, ISAIAH, 1828  
 LUKENS, JAWOOD, 1902-1908  
 LYMAN, BENJAMIN S., 1901-1902  
 McALPINE, JAMES, 1825-1828  
 McCaffrey, E. V., 1910-1924  
 McCAMBRIDGE, RICHARD, 1876  
 McCLURE, JOHN, 1853-1856  
 McCLURG, ALEXANDER, 1833-1839  
 McEuen, THOMAS, 1829  
 McKean, WILLIAM V., 1879-1883  
 MARKS, WILLIAM D., 1881-1884  
 MARSHALL, SAMUEL R., 1887-1893  
 MASON, DAVID H., 1824  
 MASON, JAMES S., 1861  
 MEGARGEE, CHARLES, 1858  
 MEIRS, RICHARD WALN, 1908-1917  
 MERRICK, J. VAUGHAN, 1864-1866, 1870-1884  
 MERRICK, SAMUEL V., 1824-1827, 1830-1841, 1855-1863  
 MIFFLIN, LLOYD, 1825-1826  
 MILES, FREDERICK B., 1874  
 MILLER, ABRAHAM, 1824-1846, 1855-1858  
 MITCHELL, J. E., 1874  
 MITCHELL, WILLIAM A., 1864-1865  
 MOORE, BLOOMFIELD H., 1864-1868  
 MOORE, JOSEPH W., 1860-1861  
 MORGAN, MARSHALL S., 1914-  
 MORRIS, ELWOOD, 1844-1847  
 MORRIS, HENRY G., 1864-1869  
 MORRIS, ISAAC P., 1836-1843  
 MORRIS, WILLIAM E., 1847-1851  
 MUCKLE, M. RICHARDS, JR., 1894-1896  
 NAYLOR, JACOB, 1863, 1865-1872  
 NEAFIE, JACOB G., 1868  
 NEWHALL, PAUL W., 1843-1844  
 NORRIS, ISAAC, 1870-1878, 1883-1918  
 NYSTROM, JOHN W., 1873-1875  
 OGDEN, JOHN M., 1833  
 OGLE, WILLIAMS, 1845-1850  
 O'NEILL, JOHN, 1827-1832  
 ORR, HECTOR, 1871-1887  
 OUTERBRIDGE, ALEX. E., JR., 1881-1886  
 PALMER, B. FRANKLIN, 1862

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 PARRY, CHARLES T., 1864  
 PATTERSON, ROBERT, 1824  
 PATTERSON, ROBERT M., 1825-1827  
 PAUL, LAWRENCE T., 1895-  
 PEMBERTON, HENRY, JR., 1891-1896  
 PENROSE, CHARLES, 1925-  
 PERRY, ROBERT S., 1912-1916  
 PETTIT, HORACE, 1894-1910  
 PURVES, ALEXANDER, 1875-1876  
 RALSTON, ASHBEL G., 1825-1830  
 RAMAGE, ADAM, 1824-1832  
 RAND, THEODORE D., 1874-1897  
 REED, WILLIAM B., 1832-1836  
 REEVES, BENJAMIN, 1829-1837  
 REEVES, SAMUEL J., 1864  
 REEVES, STACY, 1889-1902  
 RICE, JOHN, 1866-1867  
 RICHARDS, MARK, 1831  
 RICHARDSON, JOHN, 1825  
 RIEHLE, HENRY J., 1826-1827  
 ROBBINS, SAMUEL J., 1827-1833  
 ROBERTS, ALGERNON S., 1828  
 ROBERTS, PERCIVAL, 1864-1868  
 ROBERTS, SOLOMON W., 1842-1847  
 ROBINSON, ALEXANDER P., 1911-1916  
 ROGERS, EVANS, 1854-1863  
 ROGERS, HENRY D., 1838-1843  
 ROGERS, JAMES S., 1909-  
 ROGERS, ROBERT E., 1867  
 RONALDSON, CHARLES E., 1885-1893, 1908-1912  
 ROSENGARTEN, GEORGE D., 1912-  
 ROWLAND, JAMES, JR., 1829-1830  
 ROWLAND, WILLIAM, 1828  
 RUSH, WILLIAM, 1825  
 RUST, JAMES I., 1824  
 SADTLER, SAMUEL P., 1888-1897  
 SANBORN, E. H., 1907-  
 SARTAIN, JOHN, 1877-1879  
 SARTAIN, SAMUEL, 1865-1882  
 SAVERY, PELEG B., 1851-1852  
 SAXTON, JOSEPH, 1842-1844  
 SAY, BENJAMIN, 1832-1833  
 SCATTERGOOD, THOMAS, 1829-1834  
 SCHAUM, OTTO W., 1907  
 SCHREINER, JOSEPH H., 1827-1832  
 SCHUMANN, FRANCIS, 1899-1902  
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 SELLERS, COLEMAN, JR., 1906-1911  
 SELLERS, WILLIAM, 1857-1861, 1867-1892  
 SHAIN, CHARLES J., 1884-1887  
 SHINN, EARLE, 1836-1837  
 SLOAN, SAMUEL, 1864  
 SMITH, CHARLES E., 1852-1855  
 SMITH, HASELTINE, 1922-  
 SOUDER, JACOB, 1828  
 SPANGLER, HENRY W., 1891-1893  
 STEVENSON, WILLIAM, JR., 1828  
 STEWART, THOMAS S., 1842-1850, 1852-1863  
 STRICKLAND, WILLIAM, 1828  
 STRUTHERS, JOHN, 1827-1849  
 TABER, GEORGE, 1839-1842  
 TATHAM, WILLIAM P., 1870-1878, 1886-1887  
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 THOMSON, ELIHU, 1878-1881  
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 TILGHMAN, BENJ. C., 1871-1875  
 TOPPAN, CHARLES, 1831-1832  
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 TOWNSEND, EDWARD Y., 1866-1867

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WALLIS, J. T., 1923-	WILLIAMS, EDWARD H., 1871-1872
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A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.





The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 201 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of about 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

## INSTRUCTION

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824, and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages." This project was realized in 1826. In 1827 over three hundred scholars were upon its



technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

### MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

### EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute coöperated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

**MODELS AND HISTORICAL APPARATUS**

This collection includes the electrical machine used by Doctor Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Doctor Priestley's air pump, brought by him to America in 1794; odometer used by Doctor Franklin when postmaster-general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1" locomotive built for the Stockton and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.

# **HISTORICAL EXTRACTS**

**(CHRONOLOGICALLY STATED)**

About a century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Professor Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania, and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Professor Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Professor Keating set about to carry it into execution.

Four of the committee selected from 1200 to 1600 names of citizens from the City Directory and invited them to attend another meeting to be held at the county court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the county court house, Sixth and Chestnut Streets, for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry, delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of

blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock the corner-stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Monroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Mifflin, A. G. Ralston.

**Building Committee of the Hall:**

Peter A. Browne, S. R. Wood, S. V. Merrick, James McAlpin, J. B. Garrigues.

Architect, Jno. Haviland.

M. Carpenter, Jas. Clarke.

M. Marble Mason, John Struthers.

M. Bricklayer, Daniel Groves.

The assembly was then addressed by P. A. Browne, Esq., and Adjourned.

(From the minutes of The Franklin Institute, Vol. A.)

Dr. Thomas P. Jones appointed Professor of Mechanics and Natural Philosophy.

October 6, 7 and 8, second exhibition of American manufactures held in Masonic Hall, Chestnut Street, west of Seventh. The number of articles exhibited far exceeded that of the previous year. Eighty-five premiums were offered. Six hundred and ninety-nine articles are listed in the catalogue of exhibits.

1826, January. First number of THE FRANKLIN JOURNAL was issued under the editorial management of Dr. Thomas P. Jones. In addition to his position as Editor, Doctor Jones also acted as Recording Secretary of the Institute and Curator of its collections. April 12, 1828, he was appointed Superintendent of the U. S. Patent Office.

It extended its educational efforts by establishing on April 6 a High School in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October, 300 were studying English, 153 French, 105 Latin, 35 Greek, 45 Spanish, 20 German, 300 Elocution, 240 Geography, 231 Drawing, and all of them Mathematics. The School was continued until 1832 and was the predecessor of the Central High School.

October 3, 4, 5, 6, third exhibition of American manufactures was held in Masonic Hall. Silver medals were awarded for soft iron castings, flint glass ware, china from American materials, skirting and japanned leather, white lead, etc. Thirty-four thousand visitors.

1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the JOURNAL





of seventeen was appointed to consider the matter. The extensive report which included a detailed statement on the weights and measures of France, England and the United States, as well as an authentication of the Troy pound used in the United States Mint, appeared in the *JOURNAL* for November, 1833, and February to July inclusive, 1834. The Governor requested the committee to superintend the construction of the standards.

The present laws of the State are based on the recommendations made as a result of this investigation.

October 1 to 5 inclusive, eighth exhibition of domestic manufactures held in Masonic Hall. Over seven hundred exhibits. Fifty thousand visitors. Silver medals were awarded for lamps, pianos, rifles, hardware, carpets, cotton and woolen goods, etc.

1834. Joint committee of The Franklin Institute and the American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests. A circular issued by the committee requested observers to note the direction of the wind; to collect all information concerning storms—their width, direction, velocity, etc.; and the beginning and end of all rains. Detailed instructions were given for taking the “dew point.” The committee consisted of eight members, three from the American Philosophical Society and five from The Franklin Institute, Dr. James P. Espy acting as Chairman. This committee continued its work successfully until 1838, when that portion appointed by the Philosophical Society were discharged by that body and the Board of Managers at once appointed a standing Committee on Meteorology to continue the collection of the data. By an Act of the Legislature, passed March 31, 1837, two thousand dollars were appropriated with the further sum of one thousand dollars for each of the two years next ensuing, for the purpose of promoting the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, gingham, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical



1847, October 19 to 30 inclusive, seventeenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for blankets, shawls, woolen and worsted yarn, bars of iron, the chandelier made for the Opera House at New York, machinery, glass ware, book binders' dies, chemicals, etc. Seventeen hundred and forty-two exhibits.

1848, October 17 to 28 inclusive, eighteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for cotton and woolen goods, carpets, specimens of iron, lamps and gas fixtures, hardware, glass ware, furs, chemicals, etc. A first premium was awarded for a copy of the Webster dictionary, designed as a present to the Queen of England. Seventeen hundred and fifty-one exhibits.

1849, October 16 to 27 inclusive, nineteenth exhibition of American manufactures, held in the Philadelphia Museum Building. Silver medals were again awarded for products made from cotton and woolen materials, hardware and cutlery, also for Daguerreotypes, Talbottypes and Hyalotypes, boots and shoes, chemicals, needlework, etc.

1850. The School of Design for Women was founded by the Institute. Mrs. Sarah Worthington Peter, first Directress. Classes in art and design for women had been conducted by Mrs. Peter in her home, 327 South Third Street, for six years prior to the establishment of the school by the Institute.

In 1851 a room was leased at 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock



for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of arts and manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject. A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this committee resulted in the passage, by Congress, on March 3, 1871, of an Act to Provide for celebrating the 100th Anniversary of American Independence by holding an International Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1871. The committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August, 1871. The concluding report was published in August, 1872, and was fully discussed at the Stated Meeting of the Institute held in October, 1872 (*J. F. I.*, December, 1872, Vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873, and appear in the *JOURNAL* for December, 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Prof. J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (*J. F. I.*, Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Prof. Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874, the Legislature passed a bill providing for a state survey, which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the committee.

At the Stated Meeting of the Institute held March 19, 1873, it was resolved to recommend and petition the Legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and



Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the city and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without federal or state aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. Two hundred and sixteen exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.





The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the coöperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the president of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897, and January and February, 1898.

1899. National Expert Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States, presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS, It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

*Resolved*, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

*Resolved*, That the National Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the JOURNAL for June, July and August, 1902.

In order to promote both domestic and foreign commerce, the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18.



invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

*Resolved*, That a committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the coöperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition. Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air," by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life member of the Institute, for research. "Bartol Research Foundation," established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D.Sc., F.R.S., Fellow of Trinity College, Cambridge, England, delivered a course of lectures on "Atomic Weights and Isotopes."

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924, September 17, 18, 19. The centennial anniversary of the founding of The Franklin Institute in 1824 was celebrated by noteworthy exercises extending over three days, and at the same time exercises inaugurating the activities of the Bartol Research Foundation were held. These exercises consisted of formal conferences of a scientific nature, lectures by distinguished scientists, receptions, and the formal opening of the Bartol Research Laboratories, and were terminated by a great dinner given to the delegates and members of the Institute.

The delegates were received formally on the first day of the celebration. Lectures by forty-six world-renowned scientists and inventors were delivered during the three days. The hospitable citizens of Philadelphia entertained the delegates and visitors by luncheons, dinners, and lawn fêtes. Appropriate exercises were held at the Bartol Laboratories to signalize the completion of the preparations for active work under the Foundation.

The final centenary dinner brought together what was probably the most distinguished gathering of scientists from all the world ever collected in America. Greetings and congratulations, both formal and informal, were presented from all the institutions and societies represented. Speeches were made by at least one representative of every foreign country from which a delegate was present, and by representatives of the University of Pennsylvania and Princeton University. All expressed congratulations to the Institute for its honorable history and its long record of usefulness and all uttered confident good wishes for continued growth and success.

The lectures delivered during the Centenary Celebration were subsequently published by the Institute in the form of monographs.

1925, October 1. The first Bartol Research Foundation Fellow was appointed and active research work at the Laboratories was inaugurated.

# CHARTER AND BY-LAWS

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## THE FRANKLIN INSTITUTE

### OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the said



hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products, by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.





SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Controller, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

## ARTICLE II.—*Members*

SECTION 1. Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. All persons interested in the purposes and activities of the Institute, and who are willing to further them, may become members when proposed by members in good standing and elected by the Board of Managers. The membership of the Institute shall consist of the following classes of members, *viz.*, Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Student, and holders of Second-class Stock.

SEC. 2. Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote nor to hold office. All other members shall be elected by the Board of Managers.

SEC. 3. Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year without payment of dues that number of persons, to be determined from time to time by the Board of Managers, whose annual dues if they were paying annual Resident Membership dues would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise: Provided, however, that the Board of Managers at any time may refund Five Thousand Dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

SEC. 4. Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of Three Hundred Dollars (\$300). A Contributing member shall have the right to nominate nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

SEC. 5. Resident Life members, whose memberships shall not be transferable, are those members who shall pay the sum of Three Hundred Dollars (\$300) in any one year. Non-resident Life members shall be those who reside



memberships shall be added to the capital account of the Institute, and only the income therefrom shall be applied to current expenses.

#### ARTICLE IV.—*Election of Officers*

SECTION 1. The officers shall be a President, three Vice-presidents, a Secretary, a Treasurer, a Controller, a Librarian, and twenty-four Managers.

SEC. 2. At the annual meeting of the Institute the President and the Treasurer shall be elected to serve one year, and one Vice-president, and eight Managers, shall be elected to serve for three years; provided, that the officers now elected or who may hereafter be elected shall continue to serve until their successors be elected.

SEC. 3. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy.

SEC. 4. Nominations for President, Vice-president, Treasurer and Managers shall be made in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 5. On the date of the annual meeting, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

#### ARTICLE V.—*Duties of Officers*

SECTION 1. The President shall be the executive head of the Institute and as such shall have the general direction and supervision of all the affairs of the Institute. He shall preside at all meetings of the Institute and of the Board of Managers and shall be *ex officio* a member of all committees of the Institute and of the Board.

SEC. 2. The Vice-presidents shall exercise the duties of the President in his absence in the order of their seniority in office.

SEC. 3. The Secretary of the Institute shall be appointed by the Board of Managers and shall have charge and supervision, subject to the Board of Managers, of all the scientific activities of the Institute, other than those connected with the Bartol Research Foundation, its publications, museum and equipment. He shall keep the minutes of all meetings of the Institute and



reported thereat as having resigned, unless it be unanimously voted by the Board at that meeting, that such member has been absent for sufficient reason.

SEC. 6. All vacancies on the Board of Managers shall be filled by the Board until the next annual meeting of the Institute.

#### ARTICLE VII.—*Committees of the Board of Managers*

The following standing committees of the Board of Managers, each consisting of five members, shall be appointed by the President and approved by the Board:

1. Executive.
2. On Endowment.
3. On Finance.
4. On Membership.
5. On Publications.
6. On Bartol Research Foundation.

The Executive Committee shall make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

The Committee on Finance shall have charge of all securities and investment funds belonging to the Institute and shall invest and reinvest the same and pay the income therefrom to the Treasurer of the Institute. The Committee may, with the approval of the Board of Managers, appoint a trust company of the City of Philadelphia to act as fiscal agent under the direction of the Committee. All purchases or sales of securities shall be reported monthly to the Board.

The Bartol Research Foundation Committee shall have charge of the provision, maintenance and operation of all laboratories and equipment concerning the Bartol Research Foundation. It shall engage the professional staff subject to the approval of the Board of Managers of the Institute and shall also engage and direct the operators and helpers employed in the work of the Foundation. It shall be composed of not more than twelve members, as follows: Five members of the Board of Managers, appointed by the President and approved by the Board; the President; the Director of the Bartol Research Laboratories; five members appointed by the President with the approval of the Board from the membership of the Institute not members of the Board.

The Director of the Bartol Research Laboratories shall report to the Bartol Research Foundation Committee. All other employees of the Foundation shall report to the Director. The Committee shall have full power to carry out the purposes of the Foundation. It shall make a report of its operation to the Board of Managers at each stated meeting.

#### ARTICLE VIII.—*Audits*

The accounts of the Treasurer and of the Fiscal Agent shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

#### ARTICLE IX.—*Committees of the Institute*

SECTION 1. There shall be the following standing committees of the Institute:

1. On Library.
2. On Meetings.
3. On Museum.
4. On Science and the Arts.



4. Reports from Standing Committees of the Board of Managers:
  - (a) Finance.
  - (b) Membership.
  - (c) Publications.
  - (d) Bartol Research Foundation.
  - (e) Endowment.
  - (f) Executive.
5. Reports from Standing Committees of the Institute:
  - (a) Library.
  - (b) Meetings.
  - (c) Museum.
  - (d) Science and the Arts.
6. Reports from Special Committees.
7. Deferred Business.
8. New Business.

*Reports.*

All committees of the Board shall keep regular minutes of their proceedings and shall report monthly to the Board; they shall also report, through the Committee on Finance, to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.





**The John Price Wetherill Medal** (Silver Medal and Certificate).—This medal is awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

**The Edward Longstreth Medal** (Silver Medal and Certificate).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

**The Certificate of Merit.**—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

**The Boyden Premium** (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

### HISTORY OF THE MEDALS

**The Franklin Medal.**—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.



**The Louis E. Levy Medal.**—Under date of December 12, 1923, the following letter was received from Mr. Lionel F. Levy, a member of the Committee on Science and the Arts:

"To The Board of Managers of  
"The Franklin Institute of The State of Pennsylvania,  
"Philadelphia, Pennsylvania.

"Gentlemen:

"Understanding from my associates on your Committee on Science and the Arts that a feeling obtains among them that the purposes of the Institute would be aided should there be available to the Institute a medal for the recognition of contributions to the JOURNAL, I take the liberty of addressing you to say that my brother, Mr. Howard S. Levy, my sister, Miss Hortense Levy, and I will be glad to found a medal in memory of our Father, the late Louis E. Levy, under the following general conditions:

"First: That we furnish a sum not exceeding five hundred (\$500) dollars to cover the cost of an appropriate design and the necessary dies and diplomas.

"Second: That the medal be of gold and have an intrinsic value of about sixty (\$60) dollars.

"Third: That we furnish the sum of two thousand (\$2000) dollars to be known as the Louis E. Levy Medal Fund.

"Fourth: That the interest on this fund shall be used from time to time in awarding the Louis E. Levy Medal for papers contributed to the JOURNAL of the Institute, descriptive of the author's researches in physical science or of his engineering achievements, which have added largely to the sum of knowledge or aided greatly the well-being of mankind.

"Fifth: That any excess of income from this fund beyond that necessary for the number of medals which the Institute may think best to award shall be added to the Louis E. Levy Library Fund.

"I am,

"Very truly yours,

"(Signed) LIONEL F. LEVY."

This matter was brought to the attention of the Board of Managers at their meeting on December 12, 1923, and the proposed fund was accepted.

**The George R. Henderson Medal.**—Under date of September 24, 1924, the following communication was presented to the Acting Secretary:

"I herewith present to The Franklin Institute the sum of two thousand five hundred dollars (\$2500). Of this amount a sufficient sum is to be used for the cost of preparing dies for a medal to be known as the George R. Henderson Gold Medal which is to be awarded by the Institute on the recommendation of the Committee on Science and the Arts for meritorious inventions or discoveries in the field of railway engineering. The remaining amount is to constitute a fund in trust, the net income from which, or such portion thereof as may be needed, shall be used for the purchase of the said gold medal as required.

"Any accumulation after providing the medals shall, after each period of five years, be added to the trust fund, and if this fund increases to double



On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

**The Certificate of Merit.**—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

*"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:*

*" 'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to \_\_\_\_\_ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.*

*" 'Report No. \_\_\_\_\_ Approved, \_\_\_\_\_19 \_\_\_\_\_*

*" ' \_\_\_\_\_President.*

*" ' [SEAL]*

*\_\_\_\_\_Secretary.*

*" 'Chairman of the Committee on Science and the Arts.' "*

**The Boyden Premium.**—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

*"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of  $2 \times 10^{14}$  double vibrations per second in the infra-red and  $8 \times 10^{14}$  in the ultra-violet, travel through free space with the same velocity."*

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.



8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

#### ARTICLE III.—*Chairman*

SECTION 1. A Special Committee for nominating a Chairman for the ensuing year, consisting of three recent past Chairmen, shall be appointed at the January Meeting of the Committee, this special committee to report its nomination of a candidate at the February meeting. At this meeting, additional nominations may be made by any member of the Committee on Science and the Arts. The election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees of investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

#### ARTICLE IV.—*Standing Sub-committees*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-committee on New Subjects and Preliminary Examination." The duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to coöperate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each February by the Chairman, from the membership, a sub-committee styled the "Sub-committee on Literature," consisting of six members. It shall be the duty of this sub-committee to examine carefully all papers that are published in the Institute's JOURNAL during





SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

#### ARTICLE VI.—*Sub-committee Meetings*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

#### ARTICLE VII.—*Sub-committees' Reports*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B hereto appended.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the George R. Henderson Medal, the Howard N. Potts Medal, the John Price Wetherill Medal, the Edward Longstreth Medal or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendations may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the Chairman of the sub-committee, but without changing its meaning or effect.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—



stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

#### ARTICLE XI.—*Institute Reports*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C appended. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. On the completion of an investigation, the applicant shall be provided with a certified copy of the Institute's report.

#### ARTICLE XII.—*Amendments to Regulations*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition. It is suggested that future awards be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions and physical processes.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the John Price Wetherill Medal be awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

4. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science.

5. That the George R. Henderson Medal be awarded in recognition of meritorious inventions or discoveries in the field of railway engineering.

6. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

7. That the Louis Edward Levy Medal be awarded in recognition of papers contributed to the JOURNAL of the Institute, which are of superior excellence and descriptive of a field in science or engineering to which the author has contributed fruitful research.

8. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

# REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

## FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled .....  
..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

## IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process, together with two copies of each of the United States patents issued to applicant, must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

**YEAR BOOK OF**  
**FORM B**  
 (Sub-committee Report Form)  
**THE FRANKLIN INSTITUTE**  
**OF THE**  
**STATE OF PENNSYLVANIA**  
**FOR THE**  
**PROMOTION OF THE MECHANIC ARTS**

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....

Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject reports as follows:

.....

In consideration of the {  
 discovery  
 excellence of construction  
 ingenuity and novelty  
 or

of .....your sub-committee recommends

the award of ..... to ..... of .....

Respectfully submitted,

..... *Chairman.*

.....

.....

.....

Adopted at the Stated Meeting of ..... 19 .....

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,.....

S. & A. Case No. ....

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....  
..... reports as follows:

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... the Institute awards the.....

to ..... of .....

[SEAL] ..... President.

..... Secretary.

Countersigned .....

Chairman of the Committee on Science and the Arts.

YEAR BOOK OF  
FORM B  
(Sub-committee Report Form)  
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STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

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Respectfully submitted,  
..... Chairman.

.....

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Adopted at the Stated Meeting of ..... 19 .....

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or

of ..... the Institute awards the.....

to ..... of .....

[SEAL] ..... President.

..... Secretary.

Countersigned .....

Chairman of the Committee on Science and the Arts.



# **PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS**

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## **REPORT OF THE PRESIDENT**

**FOR THE YEAR ENDING DECEMBER 31, 1925**

*To the Members of The Franklin Institute:*

It has long been the custom, and a very pleasant duty, for the President of the Institute to submit an Annual Report upon the activities of the Institute, making a survey of the work accomplished by the various committees of the Institute and by the Committees of the Board of Managers.

### **COMMITTEE ON MUSEUM.**

The Committee on Museum, Dr. Alexander E. Outerbridge, Jr., Chairman, reports that a number of pieces of apparatus, models and interesting books and manuscripts have been added to the Institute's Museum during the past year. These donations have included specimens of eight electric lamps manufactured about 1883 or 1884, which were presented by Mr. Robert B. Haines, Jr., a member of the Institute. Note books, manuscripts and models of mechanical movements, formerly the property of Mr. John H. Cooper, a noted mechanical engineer, who was a member of the Board of Managers from 1870-1873, and an active member of the Committee on Science and the Arts, were presented by a grand-nephew of Mr. Cooper, Mr. Arthur S. Martin, 421 West Main Street, Norristown, Pennsylvania. The Pennsylvania Railroad Company has promised to donate some very significant models of early railroad apparatus. The Committee states this anticipated gift and the present invaluable possessions of the Institute bring home in a striking way the needs of the Institute for a proper museum. Until our collections, which are increasingly interesting and valuable, are housed under proper conditions, the Institute will be unable to perform its maximum service to the public.

### **COMMITTEE ON PUBLICATIONS.**

The Committee on Publications, Mr. E. H. Sanborn, Chairman, reports the noteworthy fact that the December number of the JOURNAL OF THE FRANKLIN INSTITUTE completes the two hundredth volume of the JOURNAL, and one hundred years of uninterrupted publication of this periodical—an almost unique record—no other case of such a protracted and uninterrupted period of publication of a journal of similar purpose being known to the members of this Committee. With the establishment of active research work under the Bartol Research Foundation, the pages of the JOURNAL will be enriched by the record of active research work, in addition to reports upon matters of general interest in science and upon inventions. During this period there have been additional sales of 176



magazines, and also to government departments, state and municipal officials, and numerous organizations which, from time to time, have supplied the Library with publications on technical subjects. The Committee's statement that the Library now consists of 83,927 bound and unbound volumes, 22,183 pamphlets, 2298 maps and charts, 1356 photographs, and 784 original drawings and designs, indicates in a striking way the growth of the Library. It is becoming increasingly difficult with the congested conditions of the present available facilities for housing the Library, to maintain it in an accessible and readily usable form. The efficiency of the Library and its usefulness to the members of the Institute and the general public are very seriously affected by these limitations.

#### COMMITTEE ON SCIENCE AND THE ARTS.

The Committee on Science and the Arts, Mr. Harold Calvert, Chairman, reports that investigation and final disposition were made of eighteen cases, and that thirteen cases are now pending. In fourteen of the eighteen cases investigated, awards were made; one case was tabled on account of legal complications, and one on account of the death of the inventor. The standing Sub-committees on Literature and The Franklin Medal held their customary meetings, and recommended the award of two Franklin Medals and one Levy Medal. The standing Sub-committee on New Subjects and Preliminary Examination held nine stated meetings during the year, and considered a total of fifty-two subjects. Applications were received covering ten of these subjects, and five special cases were accepted for investigation, for which no applications were required. The meetings of this Sub-committee were well attended, and careful consideration was given to the subjects presented. According to custom the awards to recipients who could personally attend the stated meetings of the Institute were presented by the President of the Institute.

In addition to The Franklin Medals which were awarded to Prof. Pieter Zeeman and Prof. Elihu Thomson, awards were made of the Louis Edward Levy Medal to Dr. Harvey C. Hayes, of Washington, D. C., of the Elliott Cresson Medal to Mr. Francis Hodgkinson, of Swarthmore, Pennsylvania; of the Edward Longstreth Medals to Mr. Thomas M. Chance, of Philadelphia, Mr. Daniel H. Meloche, of Detroit, and Mr. Thomas Midgley, Jr., of Dayton, Ohio. Medals for other recipients who were too far away to permit attendance at the stated meetings were mailed to them.

The Institute records with sorrow the death on December 18, 1925, of Mr. J. Y. McConnell, an active, efficient, and loyal member of the Committee on Science and the Arts for twenty-seven years.

Two features have marked this Committee's work during the past year; first, the establishment of the "John Price Wetherill Medal—1925," which will be "awarded for discovery or invention in the physical sciences or for new and important combinations of principles or methods already known." The Committee has long desired to have an additional medal, as it has been difficult in the past to equitably award the two medals available, namely, the Cresson and the Longstreth Medals, over a wide range of subjects of varying importance. The addition of the Wetherill Medal permits the Cresson Medal to be used for major discoveries and inventions, while this new medal can be used



therefore, the figures show a definite gain. The principal and accumulated income of the Bartol Research Foundation Fund now amount to \$1,595,742.84. The expenses of the Bartol Foundation were \$34,652.02 and the income \$88,074.54, showing a surplus of \$53,422.52.

#### **FRANKLIN FUND AND BUILDING COMMITTEE.**

The Franklin Fund and Building Committee, Mr. Henry Howson, Chairman, has prepared a very complete report showing that there is now in this Fund \$1,000,000, this being the actual value of property (based on assessed valuations) and investments. The City of Philadelphia, through the Board of City Trusts, is the Trustee of this Fund.

#### **COMMITTEE ON BARTOL RESEARCH FOUNDATION.**

The Committee on Bartol Research Foundation, Mr. C. C. Tutwiler, Chairman, reports that a Director has not yet been appointed. Considerable progress has been made, however, in getting the work of the Foundation under way. Dr. W. F. G. Swann, of the Sloane Laboratory, Yale University, and Prof. E. P. Adams, of Princeton University, have been appointed to direct the scientific activities of the Foundation until a Director is chosen. Research work of a fundamental nature dealing with problems in electricity is being conducted under their direct supervision.

In addition, special investigations are being carried out at the Foundation's Laboratories by Professors Swann and Adams through their personal assistants. During the summer Doctor Swann conducted an experiment in Sweden with the idea of securing evidence of a Corpuscular Radiation of Cosmic Origin. The results of this investigation will be published in the JOURNAL OF THE FRANKLIN INSTITUTE as a contribution from the Bartol Research Foundation. The apparatus used by Doctor Swann was made in the machine shops of the Foundation.

One Fellow, Dr. Arthur Bramley, recently of Princeton University, has been appointed and is now engaged at the Foundation's Laboratories. Additional Fellows are under consideration, several of whom will probably be appointed as soon as they can be released from work upon which they are now engaged in other scientific institutions.

The Personnel Committee, consisting of Dr. W. F. G. Swann, Dean Jos. S. Ames, of the Johns Hopkins University, and Dr. Arthur L. Day, of the Geophysical Laboratory, Washington, is making a careful survey of the field with the idea of securing eight or ten Fellows: also a Director, who will be appointed as soon as a suitable man can be found for the position.

The routine work of the Foundation is being efficiently taken care of by the staff of The Franklin Institute under the able direction of the Secretary, Dr. Howard McClenahan.

While progress in getting the work of the Foundation under way has necessarily been slow, it is now proceeding at a rate which, it is thought, justifies the statement that it will be in full operation during the present year. In the meanwhile, as will be seen from the financial statement included in the Report of the Committee on Finance, a very considerable sum has been added to the principal account.



Source.	Bound Volumes.	Unbound Volumes.	Pamphlets.	Maps.
Lea Fund .....	17	4	1	
Levy Fund .....	12			
Memorial Library Fund ....	3			
Miscellaneous Expense ....	1	1		
Moore Fund .....	34	2		1
Morris Fund .....	29	2		
Potts Fund ' .....	7	.		
Ware Fund .....	25	68	10	4
	<u>764</u>	<u>223</u>	<u>1528</u>	<u>6</u>
Total additions .....2521				

The Committee had at its disposal \$3100.00 appropriated by the Board of Managers and \$2792.01 income of the various trust funds.

The expenditures for the year were \$1008.32 for binding, \$4200.08 for books and subscriptions to magazines and other periodicals, \$144.94 for general expenses.

Gifts of books, pamphlets and magazines were received from Mr. A. C. Albrecht, Mr. Clarence A. Hall, Dr. Samuel C. Hooker, Mr. S. S. Sadtler, Mr. John C. Trautwine, 3rd, Mrs. Coleman Sellers, Jr., Mr. C. E. Schaeffer, Dr. J. E. Whitfield, Messrs. Harris and Richards, and Shoemaker Bridge Company.

The Institute is also under obligations to various government departments, state and municipal officials and to the numerous organizations who have from time to time supplied the library with publications on technical subjects.

The contents of the library on September 30, 1925, were:

Volumes, bound and unbound .....	83,927
Pamphlets .....	22,183
Maps and charts .....	2,298
Photographs .....	1,356
Original Drawings and Designs .....	784

#### *Binding:*

During the year the following work was done by the binders:

Recent volumes of periodicals .....	213
Patent Office publications (British and American).....	136
Volumes charged to the Ware Fund .....	26
Old volumes bound .....	7
Old volumes rebound .....	1

#### *Magazines and other periodical publications:*

6410 copies of the JOURNAL were distributed for exchange purposes.

40 new exchanges were added to the mailing list and 21 were removed.

The total number of exchanges on September 30 was 523.

The subscriptions for the year totalled 211, of which 114 were domestic, 61 were German, 18 were English, 12 were French, 3 were Belgian, 2 were Italian and 1 was Australian.





**REPORT OF THE COMMITTEE ON MEETINGS****FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925***To the President and Members of The Franklin Institute:*

During the year ending September 30, 1925, there were eight Stated Meetings of the Institute, with a total attendance of 743. These were held on the third Wednesday of each month, from October to May inclusive, at the hour of eight o'clock, with the exception of the meeting on May 20, which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers, with titles and synopses of their communications:

October 15, 1924: Professor Archibald Vivian Hill, O.B.E., D.Sc., F.R.S., Jodrell Professor of Physiology, University College, London, presented a paper on "The Ultimate Nature of the Muscular Machine." He described the employment of thermocouples and delicate deflection apparatus capable of indicating differences of  $0.000001^{\circ}$  Centigrade, by means of which he has followed the energy changes during the phases of muscular contraction and relaxation lasting in all only a fraction of a second. From these experiments he has made important deductions concerning the thermodynamics of the process and the nature of the mechanism involved. The subject was illustrated by lantern slides. At this meeting Dr. James Barnes, on behalf of the Committee on Science and the Arts, introduced Dr. Harvey Fletcher, of New York City, to whom was presented the Louis E. Levy Medal for his paper on "Physical Measurements of Audition and Their Bearing upon the Theory of Hearing," published in the JOURNAL of the Institute during 1923.

November 19, 1924: Dr. Harrison E. Howe, Editor of *Industrial and Engineering Chemistry*, Washington, D. C., read a paper on "The Trend and Purpose of Modern Research," which has since appeared in the February, 1925, issue of the JOURNAL. The frequent statements made concerning the importance of research, the constant appeals for funds to support it, and the increasing difficulty of giving publication to highly scientific research papers properly give rise to the questions: What is the trend and purpose of modern research? In what direction are the natural sciences, and particularly chemistry, headed? Are their problems such that if successful solutions were found the race may be expected to benefit? Answers to such questions are to be found in the types of problems being studied, particularly in the borderlands that exist between chemistry and biology, chemistry and physics, and chemistry as applied to the several major groups of engineering. Doctor Howe discussed a few of the problems that have to do with transportation, communication, public health and longevity, and indicated some of the work in progress, and some of the problems listed under the head of the chemist's unfinished business. At this meeting the Edward Longstreth Medal was presented to Mr. William F. Zimmermann, of Newark, N. J., for his invention of a hob for cutting worm gears and the method of making it.

December 17, 1924: Horace C. Porter, Ph.D., of Philadelphia, presented a paper on "Low Temperature Coal Carbonization and Its Prospective Industrial Application," which was accompanied by experimental demonstrations, samples of commercial products and lantern slides. The speaker pointed out that low temperature carbonization offers many features of promise for relief



which were tested in units of varying size to ascertain strength and efficiency. Model cable sections were compacted in order to predict size of finished cable, and full-size tests were made to investigate secondary stresses induced by bending and the resistance of the cable bands against sliding. Both papers were illustrated by lantern slides. At this meeting the Louis E. Levy Medal was presented to Dr. Harvey C. Hayes for his paper on "Measuring Ocean Depths by Acoustical Methods," which appeared in the March, 1924, issue of the JOURNAL.

March 18, 1925: E. G. Zies, Ph.D., Geophysical Laboratory, Carnegie Institution of Washington, presented a paper, which was illustrated by a series of colored lantern slides, on "Volcanic Incrustation in the Valley of Ten Thousand Smokes." He gave a brief account of the fumarolic area in the volcanic region of Alaska called the Valley of Ten Thousand Smokes, and described the general characteristics of the incrustations and the probable method by which the various constituents were transported and concentrated. He also referred to the mineralogical changes that are liable to take place with the lowering of temperature. At this meeting the resolution of the Board of Managers recommending the election to Honorary Membership of Professor Pieter Zeeman, of Amsterdam, Holland, and Dr. Elihu Thomson of Swampscott, Mass., was unanimously adopted. The Edward Longstreth Medal was presented to Major William E. Hoke, of Washington, D. C., for his improved method of making and measuring precision gauges. The Edward Longstreth Medal was also presented at this time to Mr. Daniel H. Meloche, of Detroit, Mich., for his method of making long-life molds and their application in the quantity production of castings.

April 15, 1925: Harry N. Holmes, Ph.D., Chairman, Committee on Chemistry of Colloids, National Research Council, presented a paper on "Silica Gels," in which he described the evolution of the process of the preparation of silicic acid and its application for the selective adsorption from mixtures of vapors or gases. He referred to the method of Patrick for drying silicic acid and his special heat treatment for the preparation of a gel, and gave an account of his own investigations in this field and the more porous silica gel which he and some of his assistants have recently been able to prepare. The speaker pointed out that the use of these various forms of silica gel must include solvent recovery, drying of air for the blast furnace, and for the vacuum ice process, recovery of sulphur dioxide and oxides of nitrogen, removal of offensive odors from air, removal of sulphur compounds from petroleum fractions, decolorizing certain liquids, recovery of gasoline from natural gas and many other uses. His subject was illustrated by experiments and diagrams. The Elliott Cresson Medal was presented at this meeting to Mr. Francis Hodgkinson, of Swarthmore, Penna., for his work on turbo-electric appliances, and the Edward Longstreth Medal was presented to Mr. Thomas M. Chance, of Philadelphia, for his method and apparatus for the separation of materials of different specific gravities.

May 20, 1925: Dr. William C. L. Eglin, President, in the chair, announced the business of the meeting would be the annual presentation of the Franklin Medal in recognition of distinguished scientific and technical achievements. He



December 4, 1924: Mr. Francis F. Lucas, Research Laboratories, American Telephone and Telegraph Company, and Western Electric Company, Inc., presented a paper on "High-power Metallography—Some Recent Developments in Photomicrography and Metallurgical Research." In this paper Mr. Lucas described briefly the Bell System Laboratory for technical microscopy and discussed the equipment and optical parts used in high-power metallography. He also discussed the technique by which brilliant and crisp images are obtained, showing remarkable resolution and depth of penetration at high magnifications. The illustrations of this paper showed many new and heretofore unresolved details of metal structures, and it is felt that the practical application of this new information should lead to a better understanding of metals.

January 8, 1925: Professor F. G. Cottrell, Ph.D., Director, Fixed Nitrogen Research Laboratory, United States Department of Agriculture, Washington, D. C., spoke on "The Future of Nitrogen Fixation." He said that the enormous consumption of electrical energy in the initial or arc process for nitrogen fixation made it dependent upon cheap water power. The later trend has been toward processes requiring less and less electric power and making more and more use of coal and its products as chemical reagents. Further promising development is plainly in sight along these lines, while beyond, distinctly new possibilities and avenues of approach are already faintly emerging from the haze.

January 29, 1925: Wilder D. Bancroft, Ph.D., Sc.D., Cornell University, Ithaca, N. Y., presented a paper on "Metallic Luster." He said that we get the sensation of metallic luster from metals, opaque crystals such as pyrites or stibnite, from transparent crystals such as methyl orange, from total reflection, from selective reflection with crystals of magenta, from exfoliated mica, from oil films, from the throat feathers of the humming bird and the breast feathers of the peacock, from moonlight on the water, and from the stereoscopic combination of differently colored images; and he showed that the problem is to find what characteristics are common to all of these cases.

March 5, 1925: Professor Robert H. Fernald, Director Mechanical Engineering, Towne Scientific School, University of Pennsylvania, presented a communication on "Fuel Conservation: Fact or Fancy." He discussed the basic causes of our fuel wastes and extravagances, and then took up the subject from the standpoint of the three general classes of fuel: Solid, liquid and gaseous. Under the first subdivision, he spoke of the present uses of coal, and contrasted the reasonable savings that might be made and the extravagances of to-day. Special emphasis was placed upon the use of coal at the mines, by the railroads, by the industries, in domestic plants, in coke making, in coal gas manufacture and on steamships. In a similar way, our original petroleum resources were outlined, and our alarming rate of consumption was stressed. There was some detailed discussion of the use of oil by industrial and stationary plants, merchant marine and navy, and the railways. Then the question was taken up of the supply of gasoline and of the use of substitutes, and the future possibilities of oil from shales was considered. Next was pictured the abominable waste of our natural gas supply and the straits to which we are now put to find substitutes for this material. Dr. Fernald concluded his paper by pointing out definite steps that should be followed by engineers and scientists



Honorary Members .....	3
Life Members .....	2
Contributing Members .....	44
	<hr/>
	116

## RESIGNATIONS:

Resident Members .....	6
Non-resident Members .....	6
	<hr/>
	12

## DEATHS:

Resident Members .....	7
Non-resident Members .....	2
Honorary Members .....	1
Second-class Stock Members .....	2
	<hr/>
	12

## SUMMARY:

Elections .....	116
Resignations .....	12
Dropped for non-payment of dues .....	17
Deaths .....	12
Net increase in membership .....	75

## Membership of the Institute by Classes, September 30, 1925.

Resident Members .....	521
Non-resident Members .....	582
Life Members .....	193
Honorary Members .....	30
Associate Members .....	17
Second-class Stock Members .....	21
Corresponding Members .....	2
Contributing Members .....	44
	<hr/>
Total .....	1410

It is hoped that during the year 1926 much larger increases will be shown, in view of the fact that during 1925 there were created two new classes of membership, one Contributing Members, of which there were 44 elected in 1925, representing various industrial establishments in Philadelphia taking out this class of membership; and the other Student Membership for boys and young men, with very low dues, by means of which it is expected that interest in The Franklin Institute will be awakened in the schools and collegiate institutions in and around Philadelphia.

During the recent autumn, plans have been completed by a specially appointed Committee, and the Membership Committee, for continuing efforts to increase the membership of the Institute and to extend its usefulness. The Committees have prepared a circular letter to which are attached the names

of nineteen influential citizens of Philadelphia. The Committees have also prepared a circular which gives in readable form an outline of the history of the Institute, and shows what the Institute has done for the City and State. These documents have been printed in large numbers and will be used by all interested in the Institute in the efforts to increase the membership.

Respectfully submitted,

R. W. LESLEY,  
Chairman.

PHILADELPHIA, January 13, 1926.

## REPORT OF THE COMMITTEE ON FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the Board of Managers of The Franklin Institute:

The Committee presents the following statement:

### PROPERTY AND FUNDS

Building and Land, 13-17 South Seventh Street.....	\$60,000.00		
Library .....	100,000.00		\$160,000.00
		Principal.	Unexpended
		Income.	
Funds held by Board of Trustees .....	\$648,822.65	\$2,349.84	
Funds held by Board of Managers.....	176.20		
Franklin Institute Building Fund.....	571,413.90		
Elliott Cresson Medal Fund .....	3,000.00	1,149.16	
Franklin Fund and Building Committee....	17,470.19		
Total Funds .....	\$1,240,882.94	\$3,499.00	\$1,244,381.94
Grand Total .....			\$1,404,381.94

### LIABILITIES

Certificates of Stock .....	\$28,794.00
Bills Payable .....	45,000.00
Vouchers Payable .....	2,554.19
Unearned Income .....	115.00
	\$76,463.19

### INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED SEPTEMBER 30, 1925

#### INCOME

Dues—Resident .....	\$7,612.50	
Non-resident .....	2,817.50	
Second-class Stock .....	252.00	
Associate .....	85.00	
Contributing .....	330.00	\$11,097.00
Initiation Fees .....		170.00
H. Belfield Memorial Fund .....		263.44



James H. Cresson Memorial Fund .....		\$2,291.16
General Endowment Fund .....		18,676.54
John H. Wahl Fund .....		4,359.29
Lewis S. Ware Library Fund .....		600.00
Estate of John Turner .....		167.24
Estate of Robert Wright .....		2,164.76
Augene P. Rogers Donation acct. ....		1,756.26
Publications—Subscriptions and Sales .....	\$4,194.18	
Advertising .....	5,403.80	9,597.98
<hr/>		
“Physics of the Air” .....		250.00
Miscellaneous Income and Expense .....		74.28
<hr/>		
Total .....		\$51,467.95

## EXPENSES

Building—Wages .....	\$1,961.46	
Repairs and Maintenance .....	492.86	
Taxes, Water Rent and Insurance .....	102.28	
Heat, Light and Power .....	772.63	
Miscellaneous Supplies and Expense .....	389.88	\$3,719.11
<hr/>		
Instruction—Salaries and Annuities .....		250.00
Library—Salaries .....	\$10,062.50	
Books and Periodicals .....	2,029.82	
Binding .....	984.80	
Miscellaneous Expense .....	144.94	13,222.06
<hr/>		
Meetings .....		2,943.62
Office and General—Salaries .....	\$14,164.63	
Office Expense .....	1,391.62	
General Expense .....	1,354.06	
Auditor and Treasurer .....	300.00	\$17,210.31
<hr/>		
Publications—Printing .....	\$13,675.90	
Illustrating .....	3,380.53	
Miscellaneous Expense .....	756.80	
Year Book .....	1,166.69	
Reprints .....	825.63	19,805.55
<hr/>		
Science and Arts .....		2,643.67
Interest and Discount .....		2,108.20
Badges and Certificates .....		177.70
<hr/>		
Total .....		\$62,080.22
<hr/>		
Deficit .....		\$10,612.27



Year Book:		
Advertising .....		\$179.00
Reprints:		
Sales .....		839.06
		<hr/>
Total Income .....		\$10,616.04
		<hr/>
Net Cost .....		\$10,207.57

This figure of \$10,207.57 takes no account of the part of the subscriptions of the members which should be allotted to the JOURNAL for those numbers of the JOURNAL which are sent without charge to all members of the Institute.

Respectfully submitted,

E. H. SANBORN,  
*Chairman.*

PHILADELPHIA, January 13, 1926.

**REPORT OF COMMITTEE ON ENDOWMENT**  
**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925**

*To the Board of Managers of The Franklin Institute:*  
Your Committee on Endowment begs to report that the only endowment received during the fiscal year ending September 30, 1925, was one from John Henry Towne, same to be known as the John Henry Towne Memorial Fund; amount \$10,000. This Endowment Fund is without restriction as to use.

Respectfully submitted,

G. H. CLAMER,  
*Chairman.*

PHILADELPHIA, January 13, 1926.

**REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS**  
**FOR THE FISCAL YEAR ENDING JANUARY 31, 1926**

*To the President and Members of The Franklin Institute:*  
The year 1925 marked the ninety-first year of the existence of the Committee on Science and the Arts. During the period covered by this report investigations and final disposition were made of eighteen cases and thirteen are now pending. In the appendix to this report will be found the name of the inventor and of the invention and the award made in each case.  
In fourteen of the eighteen cases investigated awards were made, one case was tabled on account of legal complications and one on account of the death of the inventor. After investigation two cases were dismissed without prejudice.  
The Standing Committee on Literature and the Franklin Medal held their customary meetings and recommended the award of two Franklin Medals and one Levy Medal. Detailed statements of these awards are given under the head of The Franklin Institute Awards.  
The Sub-committee on New Subjects and Preliminary Examination held nine stated meetings during the year and considered fifty-two subjects. Applications were received covering ten of these subjects and five special cases were



## YEAR BOOK OF

The two features which mark the past year of the Committee on Science and the Arts are, first, the establishment of a new medal and, second, the record-breaking attendance at the meetings.

The Wetherill Medal, as already described, fills a need that has long been felt by the Committee. It has been difficult in the past to equitably award the two medals available—the Cresson and the Longstreth—over a wide range of subjects of varying importance. The addition of the Wetherill Medal permits the Cresson to be used for major discoveries or inventions while this new medal can be used for improvements or developments of a grade higher than those for which the Longstreth has been allotted.

The past year has also been notable for the large attendance at the meetings. Moreover this has been entirely spontaneous, no effort having been made to boost the attendance. While this has been gratifying, it is a fact that there are members on the Committee who but rarely, if ever, attend. These members may be individually valuable but their services cannot be fully realized unless they attend the regular meetings of the General Committee. It is hoped that the succeeding years will see a greater attendance of these members.

The dinners which precede the meetings, while not officially a part of the activities of the Committee on Science and the Arts, have also been unusually well attended. These dinners give the members a better opportunity to become acquainted and add to the personal interest of those serving together on the Sub-committees.

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Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHERE, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

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Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

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The Wetherill Medal, as already described, fills a need that has long been felt by the Committee. It has been difficult in the past to equitably award the two medals available—the Cresson and the Longstreth—over a wide range of subjects of varying importance. The addition of the Wetherill Medal permits the Cresson to be used for major discoveries or inventions while this new medal can be used for improvements or developments of a grade higher than those for which the Longstreth has been allotted.

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COWLES, EUGENE H. AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHERE, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

## CRESSON MEDAL AWARDS

ELDRED, BYRON E.

Low-expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUT.

Electric Motor and Battery.—1881.

HADFIELD, SIR ROBERT A.

Advancement of Metallurgical Science.—1910.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

CRESSON MEDAL AWARDS

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HODGKINSON, FRANCIS.

Turbo-electric Appliances.—1925.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

HOWE, H. M.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

LANSTON, T.

Monotype Machine.—1896.

LEVY, L. E.

Acid Blast Method and Apparatus for Etching Metal Plates.—1900.

LEVY, L. E.

Machine for Powdering Plates for Etching.—1904.

LEWIS, COL. ISAAC NEWTON.

Machine Gun.—1918.

LINDE, KARL P. G.

Refrigeration Processes.—1914.

LOWE, THADDEUS S. C.

Water Gas Process and Apparatus.—1886.

LOVEKIN, L. D.

Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.

LUMIÈRE, AUGUSTE AND LOUIS.

Color Photography.—1909.

## CRESSON MEDAL AWARDS

MALLET, A.

Articulated Compound Locomotive.—1908.

MARKS, G. E.

Improvements in Artificial Limbs.—1893.

MASON AND HAMLIN COMPANY.

Liszt Organ.—1901.

MERGENTHALER, O.

Linotype.—1889.

MICHELSSEN, A. A.

Work in Physical Optics.—1912.

MOISSAN, HENRI.

Investigations with the Electric Furnace.—1898.

MORLEY, E. W.

Determination of Fundamental Magnitudes in Chemistry.—1912.

NOBLE, ALFRED.

Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E., JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine.—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

## ORESSON MEDAL AWARDS

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART, and COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, SIR ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

SAUVEUR, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signaling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

SPELLIER, LOUIS H.

Time Telegraph.—1881.

SPRAGUE, F. J.

Multiple Unit System of Electric Traction.—1903.

SQUIER, MAJOR GEO. OWEN.

Multiplex Telephony.—1912.

STEINMETZ, C. P.

Application of Analytics to Electrical Engineering.—1913.

STRATTON, S. W.

Leading Work in Metrology.—1912.

TALBOT, B.

Open Hearth Steel Process.—1909.

TATHAM, W. P.

Printing Press.—1875.

TAYLOR, E. R.

Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.

TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.

Process of Treating Tool Steel.—1902.

## CRESSON MEDAL AWARDS

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

U. S. GEOLOGICAL SURVEY.

Exhibit of Survey.—1900.

UNDERWOOD TYPEWRITER COMPANY.

Typewriter.—1909.

VAUCLAIN, S. M.

Compound Locomotive.—1891.

VERNAZ, ALEXIS.

Milling Files.—1909.

VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.

Spindle Support.—1891.

WALKUP, L.

Air Brush.—1886.

WATERHOUSE, A. G., AND FORBES, JOHN S.

Art of Automatically Heating and Sterilizing Fluids.—1901.

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901.

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

“Econometer.”—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1926

ANDERSON, JOHN A.

Work in Spectroscopy and his Seismograph.—1924.

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GAERTNER, WILLIAM.

Design and Manufacture of Scientific Instruments.—1923.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-wire Anemometer.—1918.

KING, LOUIS V.

Improvement in Linear Hot-wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.



## POTTS MEDAL AWARDS

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge"  
(Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).  
—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).  
—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

WILSON, C. T. R.

Making the Tracks of Ionizing Rays Visible and Capable of Permanent  
Record by Photography.—1925.

## LEVY MEDAL AWARDS

1924-1926

FLETCHER, HARVEY.

"Physical Measurements of Audition and Their Bearing on the Theory  
of Hearing."—1924.

HAYES, HARVEY C.

"Measuring Ocean Depths by Acoustical Methods."—1925.

## WETHERILL MEDAL AWARDS

1925-

TWYMAN, FRANK.

Inventions Embodied in the Hilger Interferometer.—1925.

WAGNER ELECTRIC CORPORATION.

The Fynn-Weichsel Motor.—1925.

## LONGSTRETH MEDAL AWARDS

1890-1926

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

## LONGSTRETH MEDAL AWARDS

ACHARD, F. H., KENNELLY, A. E., AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDER, THEODORE, AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BBADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BRANDT, EDWARD J.

Automatic Cashier.—1922.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

BRISTOL, W. H.

Recording Pressure Gauge.—1894.

## LONGSTRETH MEDAL AWARDS

BROWN, HAROLD P., AND EDISON, THOMAS A.

Rail Bonds and Electrical Contacts.—1899.

CAFFREY, C. S., AND COMPANY.

Improvement in Carriages and Wagons.—1900.

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

“Continuous Electric Oscillations” (Paper).—1913.

CHANCE, E. M.

“Pathogenic Mine Atmospheres” (Paper).—1912.

CHANCE, THOMAS M.

Apparatus for Separating Materials of Different Specific Gravities.—1925.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Ventilating Stove.—1894.

COLLINS, FRANK W., AND CLARK, WM. H.

Ventilating Stove.—1894.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

“The Deteriorating Action of Salt and Brine on Reinforced Concrete” (Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

“Researches on the Corrosion of Iron and Steel” (Paper).—1908.

DANA, A. S., KENNELLY, A. E., AND ACHARD, F. H.

“Experimental Researches on the Skin Effect in Steel Rails” (Paper).  
1917.

DESHLER, CHARLES, AND MCALLISTER, EDWARD J.

Portable Photometer.—1900.

DEVÖE, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

## LONGSTRETH MEDAL AWARDS

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

EBERHARDT, HENRY F., AND ULRICH, F. L.

Radial Gang Cutter.—1904.

EDDISON, WILLIAM BARTON.

Jet Entraining Apparatus.—1921.

EDISON, THOMAS A., AND BROWN, HAROLD P.

Rail Bonds and Electrical Contacts.—1899.

EDWARDS, LEVI TALBOT.

Compound Air-Lift System.—1918.

ELLIOTT, WILLIAM SWAN.

Process and Apparatus for the Deaeration of Liquids.—1924.

ELLIS, CARLETON.

Paint and Varnish Remover.—1916.

EVE, A. S.

“Modern Views on the Constitution of the Atom” (Paper).—1916.

FAY, C. N.; SHOLES, Z. G., AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

FOLLETT, W. I.

Time Stamp.—1906.

FOLMER AND SCHWING MFG. COMPANY.

Graflex Cameras.—1905.

FORBES, J. S., AND ADAMS, W. G.

Stop Valve for Radiators.—1893.

FREAS, SAMUEL T.

“Interlocking” Tooth Saw.—1922.

FRICK, FRED.

Electric Program Clock.—1899.

FULLER, G. W.

“Biochemical and Engineering Aspects of Sanitary Water Supply”  
(Paper).—1916.

GOLDMAN, HENRY.

Arithmachine.—1901.

GOODYEAR, CHARLES.

Projection Lantern.—1895.

GRANBERY, J. H.

Stadia Rod.—1909.

HARTNESS, JAMES.

Screw Thread Comparator.—1922.

HEILPRIN, A.

Improved Ventilating Car Window.—1897.

## LONGSTRETH MEDAL AWARDS

HENNING, G. C.

Pocket Recorder for Tests of Materials.—1899.

HEPBURN, J. S.

"Chemistry of Sugar" (Paper).—1911.

HERR, H. T.

"Development of Steam Turbines" (Paper).—1914.

HICKS, THOMAS WILLING.

"Once-Over" Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N.; AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOKE, WILLIAM E.

Precision Gauge Blocks.—1925.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J., AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER Co.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, H. E.; KINGSBURY, E. F.; AND KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

IVES, H. E.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, F. E.

Photo-micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

## LONGSTRETH MEDAL AWARDS

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; AND HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

## LONGSTRETH MEDAL AWARDS

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

“Magnetic Hysteresis” (Paper).—1911.

LODGE, GEORGE.

Electro-magnetic Street Railway System.—1896.

LUCKIESH, M.

“The Visibility of Airplanes” (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MCBRIDE, THOMAS C.

Locomotive Feed Water Heater.—1924.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MELOCHE, DANIEL H.

Molds.—1925.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MIDGLEY, THOMAS, JR.

Optical Indicator.—1925.

MILEY, HENRY M. AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

“A 32-Element Harmonic Synthesizer” (Paper).—1917.

MOORE, RICHARD B.

“Biography of Sir William Ramsay” (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NACHOD, CARL P.

Electric Railway Signal System.—1924.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHROP, E. F.

“Vortex Motion in Liquids” (Paper).—1912.

PANTASOTE LEATHER COMPANY.

“Pantasote.”—1896.

## LONGSTRETH MEDAL AWARDS

PARKE, HARRY S.

Pneumercator Tank and Draft Gauge.—1923.

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W. VON.

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

“Portland Cement” (Paper).—1917.

RECKLINGHAUSEN, M. VON.

“Ultra-violet Rays” (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

“Industrial Combustible Gases” (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.



## LONGSTRETH MEDAL AWARDS

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1919.

SCHMIDT, MAX, AND SIEBER, JOSEPH.

Movable Sidewalk.—1894.

SCHMIDT, HENRY J., AND BONNELL, RUSSELL.

Gate Valves.—1901.

SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.

Portable Brinell Meter.—1917.

SCHREINER, O., AND LATHROP, E.

"Organic Constituents in Soils" (Paper).—1912.

SCRIPTURE, E. W.

Color Sense Tester.—1903.

SEITZ, HENRY JEROME.

Coal Loading and Screening Machines.—1904.

SHARPLES SPECIALTY COMPANY.

Super-Centrifuge.—1916.

SHAW, H. M.

Lightning Arrester.—1904.

SHEEN, MILTON ROY.

Expansion Machine for Tunnel Construction.—1924.

SHELLENBACH, WILLIAM L.

Variable Speed Countershaft.—1903.

SHOLES, Z. K.; FAY, C. N.; AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

SIEBER, JOSEPH, AND SCHMIDT, MAX E.

Movable Sidewalk.—1894.

SKINNER, JOSHUA J.

"Soil Aldehydes" (Paper).—1919.

SNOOK, HOMER CLYDE.

X-Ray System.—1919.

SOCIÉTÉ GENEVOISE.

Measuring Machine.—1923.

SPITZGLASS, JACOB M.

Republic Flow Meter.—1921.

STAR BRASS MANUFACTURING COMPANY.

Steam Gauge.—1894.

STEARNS MANUFACTURING COMPANY.

Automatic High Speed Engine.—1892.

STONE, JOHN STONE.

"Propagation of Electric Waves along Wires" (Paper).—1913.

STRADLING, GEORGE F.

"Modern Theories of Magnetism" (Paper).—1916.

STUMPF, J.

Una Flow Steam Engine.—1909.

## LONGSTRETH MEDAL AWARDS

SUCZEK, ROBERT, AND KOTHNY, G. L.

Radojet Air Pump.—1920.

TAINTOR, C. C.

Positive Saw-Set.—1895.

TAUSSIG, JOHN H., AND ZEEK, CHARLES F.

Automatic Operation of Water Gas Sets.—1918.

TEAL, B. F.

Anti-friction Universal Joint for Shafting.—1909.

THOMAS, C. C.

"Measurement of Gases" (Paper).—1912.

TIERNAN, MARTIN F., AND WALLACE, C. F.

Chlorinator.—1922.

TOERRING, C. J.

Electric Arc Lamp.—1903.

TOWNSEND, T. F.

Improved Thermometer Support.—1907.

TUCKER, W. H.

Letter and Document Files.—1900.

TURNER, W. V.

"Locomotive Air-brake" (Paper).—1911.

TUTWILER, C. C.

"Recovery of Gas Works By-products" (Paper).—1915.

ULRICH, FREDERICK L., AND EBERHARDT, H. E.

Radial-Duplex Gang Cutters.—1904.

UNDERWOOD, JOHN, AND COMPANY.

Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

## LONGSTRETH MEDAL AWARDS

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

“The Electric Strength of Air and Methods of Measuring High Voltage ”  
(Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

“The Annealing of Glass ” (Paper).—1921.

YAWMAN AND ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

“Locomotive Superheaters ” (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Sets.—1918.

ZIMMERMANN, WILLIAM F.

Hob for Worm Gears.—1924.

## CERTIFICATE OF MERIT AWARDS

1885–1926

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

## CERTIFICATE OF MERIT AWARDS

BULLARD, REAR-ADMIRAL W. H. G.

“The Application of Radio to Navigation Problems” (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

COPPAGE, B. DENVER.

Plastometer.—1925.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GRAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GRAY, CHARLES B.

Sheet Metal Cutter.—1925.

## CERTIFICATE OF MERIT AWARDS

GREAVES, H. A., AND ETCHHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; AND ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

## CERTIFICATE OF MERIT AWARDS

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a New Food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

PROUTY, THEODORE C. and WILLIS O.

Chronometric Tachometer.—1925.

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

## CERTIFICATE OF MEDAL AWARDS

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; AND GENERAL  
ELECTRIC COMPANY.

Magnetite Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the  
Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-off for Slide Valve Engines.—1889.





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## MEETINGS AND LECTURES

1925-1926

- Wednesday, October 21. Prof. E. G. Conklin, Professor of Biology, Princeton University, Past President American Biological Society, "Why Teach Evolution?"
- Thursday, October 29. Prof. George E. Beggs, Professor of Civil Engineering, Princeton University, "Practical Demonstration of the Mechanical Method for Solving Indeterminate Structures."
- Thursday, November 5. Lieutenant Commander Marion Eppley, U. S. N. R. F., Founder, Eppley Scientific Laboratory, Newport, R. I., "Standard Electrical Cells."
- Thursday, November 12. Prof. Charles B. Bazzoni, Professor of Experimental Physics, University of Pennsylvania, "Ultra-micrometers and Other Applications of Vacuum Tube Circuits."
- Wednesday, November 18. Prof. E. W. Brown, Professor of Astronomy, Yale University, "The Recent Solar Eclipse and Its Results."
- Thursday, December 3. Dr. E. F. Northrup, Inventor and Scientific Head of the Ajax Electrothermic Corporation, "Electric Induction Furnace Working."
- Thursday, December 10. Dr. Walter Van B. Roberts, Consulting Engineer, The Radio Corporation of America, "Recent Developments in Radio Theory."
- Wednesday, December 16. Prof. R. W. Wood, Professor of Experimental Physics, Johns Hopkins University, "Optical Excitation of Metallic Spectra."
- Thursday, January 7. Mr. John Lyle Harrington, C.E., Consulting Engineer, Kansas City, Mo., Past President of the American Society of Mechanical Engineers, "Movable Bridges."
- Thursday, January 14. Dr. Stuart C. Dodd, Professor of Psychology, Princeton University, "Applications and Mechanical Calculation of Correlation Coefficients."
- Wednesday, January 20. Dr. C. E. K. Mees, Director, The Research Laboratories, Eastman Kodak Company, "The Color Sensitivity of Photographic Materials."
- Thursday, January 28. Dr. Chas. H. Mayo, The Mayo Clinic, Rochester, Minn., "Light and Health."
- Thursday, February 4. Dr. Louis C. Loewenstein, Consulting Electrical Engineer, "Latest and Future Development in Power Generation."
- Thursday, February 11. Dr. E. W. Smith, Factory Engineer, Electric Storage Battery Company, "Storage Batteries."
- Wednesday, February 17. Prof. Theodore Lyman, Jefferson Physical Laboratory, Harvard University, "Radiations."

- Thursday, February 25. Prof. Malcolm MacLaren, Chairman, Department of Electrical Engineering, Princeton University, "The Interpole Motor: Its Theory and Development."
- Thursday, March 4. Joint Meeting, Philadelphia Branch, American Society of Civil Engineers, and The Franklin Institute, "The Delaware Bridge"—"The Erection of the Suspended Structure," R. G. Cone; "The Cable Calculations," G. M. Rapp; "The Construction of the Cables," H. D. Robinson; Engineers, Delaware River Bridge Joint Commission.
- Thursday, March 11. Prof. W. Chattin Wetherill, Department of Commerce, Washington, D. C., Department of Mechanical Engineering, University of Pennsylvania, "Elimination of Waste in Industry."
- Wednesday, March 17. Colonel E. L. Jones, Director, United States Coast and Geodetic Survey, Washington, D. C., "Science and the Earthquake Peril."
- Thursday, March 25. Dr. T. G. Delbridge, Supervisor, Process Division, The Atlantic Refining Company, "The Cracking of Petroleum."
- Thursday, April 1. Mr. W. A. Bentley, Jericho, Vt., "Marvels of Snow Flakes and Water Forms."
- Thursday, April 8. Prof. H. F. Moore, Material Testing Laboratory, University of Illinois, "Fatigue Phenomena in Metals."
- Thursday, April 15. Dr. Herbert H. Kimball, Weather Bureau, United States Department of Agriculture, "Solar Radiation and Weather Forecasting."
- Wednesday, April 21. Dr. L. W. McKeehan, Bell Telephone Laboratories, Inc., "Diamagnetism."
- Thursday, April 29. Mr. S. T. Williams, Chief Engineer, Victor Talking Machine Company, "The Recent Development in the Production of Sound."

## BARTOL RESEARCH FOUNDATION LECTURES

LECTURES BY DR. E. O. HULBURT

NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., ON MARCH 9, 12 AND 17, 1926, AT FOUR O'CLOCK, P.M.

Tuesday, March 9—"THE KENNELLY-HEAVISIDE LAYER AND RADIO WAVE PROPAGATION."

A quantitative theory, giving a clear picture of the manner of the passage of radio waves over the surface of the earth, has resulted from the recognition and measurement of the "skip distance" for radio waves below 40 metres in length. The electrons of the upper atmosphere, known as the Kennelly-Heaviside Layer, activated by the earth's magnetic field, play a crucial rôle. The shorter waves are propagated long distances by refraction in the layer and reflection at the ground, not by earth-bound waves, reaching heights of about 100 miles. At this height there are  $10^5$  electrons per c.c. The theory explains many complex phenomena of fading, directional variation, and reception with vertical and horizontal Hertz antennæ. It predicts that waves below 14 metres cannot be used efficiently for long-distance terrestrial communications, but offer a possibility of interplanetary communication.



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AKIMOFF, NICHOLAS W., Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.



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- BATES, E. F.**, 248 Sheldon Street, Philadelphia, Pennsylvania.
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- BERLINER, HERBERT S.**, Engineer, Compo Company, Limited, 131 18th Avenue, Lachine, Canada.
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- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-3856 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 113 Parkside Avenue, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, A. W. K.**, Civil, Mechanical and Electrical Engineer, in care of Brazilian Hydro Electric Company, Limited, Caixa do Correio 2444, Rio de Janeiro, Brazil.
- BILLOW, CLAYTON O.**, Consulting Engineer, 1431 Jarvis Avenue, Rogers Park, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 East Broadway Street, Portland, Oregon.
- BINDER, RICHARD L.**, President, K. and B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINSWANGER, JACK G.**, Technical Director and Chief Chemist, Thomson Wood Finishing Company, 829 North Third Street, Philadelphia, Pennsylvania.
- BIRCH, GEORGE W., Jr.**, Chemist, 19 Fairview Avenue, Highland Park, Delaware County, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 405 Hollen Road (Cedarcroft), Baltimore, Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 7028 Paschall Avenue, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLOEDE, VICTOR GUSTAVE**, Manufacturing Chemist, Carroll Post Office, Baltimore, Maryland.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.





- BURROUGHS, JOSEPH H.**, Attorney-at-Law, 612 Bullitt Building, Philadelphia, Pennsylvania.
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- BURTON, MAURICE CARTER**, Retired Lumber Manufacturer, in care of Edward F. Henson, Lafayette Building, Philadelphia, Pennsylvania.
- BUSSER, FRANK S.**, Attorney-at-Law, 904 Land Title Building, Philadelphia, Pennsylvania.
- BUTTS, DONALD C. A.**, Research Physicist and Chemist, 1730 Spruce Street, Philadelphia, Pennsylvania, and for mail, 4402 Walnut Street, Philadelphia, Pennsylvania.
- BUXTON, GEORGE E.**, Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
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Clark, Edward B.  
Coyle, George L.  
Cushman, Allerton S.  
Day, Arthur L.  
Delano, Frederick A.  
Ettinger, R. L.  
Humphreys, W. J.  
Jenkins, C. Francis.  
Jodidi, Samuel L.  
Knapp, I. N.  
Kunsman, Charles H.  
Lewis, George W.  
Lloyd, Morton G.

*Washington*—Continued

Moore, David Pelton.  
 Nutting, P. G.  
 Pershing, John J.  
 Rothermel, John J.  
 Sands, B. W.  
 Spencer, H. B.  
 Squier, George Owen.  
 Stanford, H. R.  
 Stokley, James.  
 Taylor, D. W.  
 Wiley, H. W.

## FLORIDA

*Daytona Beach*

Drake, Lewis Marvin.

*Jacksonville*

Fleming, Francis P.  
 Gibbs, E. L.

*Lakeland*

Sargent, C. E.

*Miami*

Sulzner, C. F.

*Punta Gorda*

Price, Max Charles.

## GEORGIA

*Augusta*

Bates, Onward.

*Atlanta*

Adsit, Charles G.  
 Bennett, C. E.  
 Warwick, J. F.

*Decatur*

Howson, Emily E.

## ILLINOIS

*Chicago*

Becker, Irwin A.  
 Billow, C. O.  
 Converse, W. A.  
 Duncan, J. S.  
 Eason, John Stuart.  
 Egloff, Gustav.  
 Elmendorf, Armin.  
 Felton, Samuel M.  
 Ferguson, Louis A.  
 Gibbs, Webb L.  
 Gilchrist, John F.  
 Gudeman, Edward.  
 Hoskins, William.  
 Insull, Samuel.  
 Jones, W. Clyde.  
 Lathrop, Elbert C.  
 Lyman, James.  
 McCormack, H.  
 Michelson, A. A.  
 Monroe, W. S.  
 Neiler, Samuel G.  
 Nordhaus, C. H.  
 Otis, Spencer.  
 Pearson, Frederick J.  
 Purcell, John.  
 Ritter, Louis E.  
 Spitzglass, J. M.  
 Ulmer, Carl D.  
 Van Deventer, Christopher.  
 Widdicombe, R. A.  
 Yeomans, Lucien I.

*Decatur*

Chamberlain, G. E.

*Evanston*

Carter, Edward C.

*Geneva*

Kranz, F. W.  
 Sabine, Paul E.

*Oak Park*

Parrish, T. R.

*Riverside*

Sillcox, L. K.

*Urbana*

Parr, S. W.

*Wheaton*

Finley, W. H.

## INDIANA

*Connersville*

Wilkin, John T.

*Fort Wayne*

Denig, Fred.

*Indianapolis*

Ferguson, John.  
 Spencer, Thomas.

*Lafayette*

Duncan, Thomas.

*La Porte*

Ballentine, William I.

## IOWA

*Iowa City*

Bartow, Edward.

## KENTUCKY

*Trappist*

Biddle, James C., Jr.

## LOUISIANA

*Shreveport*

Maizlish, Israel.

## MAINE

*Rumford*

Mixer, Charles A.

## MARYLAND

*Baltimore*

Ames, Joseph S.  
 Atlee, Walter.  
 Blackburn, Arthur.  
 Bloede, V. G.  
 Claghorn, Clarence R.  
 Eberle, E. G.  
 Emerson, G. H.  
 Wagner, Fred. H.  
 Wagner, Herbert A.  
 Willis, M. R.  
 Wilson, John S.  
 Wood, F. W.

*Bel Air*

Williams, S. A.

*Berwyn*

Budd, Van Wyck.

*Centreville*

Tilghman, B. C.

*Cumberland*

McKaig, W. Wallace.

*Dunkirk*

Dashiell, Benjamin J.

*Elkton*

Thomson, F. Du Pont.

*Riderwood*

Homer, F. T.

## MASSACHUSETTS

*Bass River*

Davis, Charles Henry.

**Boston**

Bannister, J. O.  
Bryant, Alice G.  
Cabot, George E.  
Clark, Frank Shaw.  
Edgar, C. L.  
Harman, J. J.  
Lawler, G. S.  
Moyer, J. A.  
Peterson, Walter.  
Robb, Russell.  
Talbot, H. P.

**Cambridge**

Chaffee, E. Leon.  
Comey, A. M.  
Kennelly, A. E.  
Little, Arthur D.  
Richards, Theodore W.  
Sagebeer, G. S.  
Umstead, C. H.

**Chestnut Hill**

Dellenbaugh, Fred S.

**East Templeton**

Greenwood, T. T.

**Fall River**

Johansen, Ernest.

**Lynn**

Coates, Jesse.

**Pittsfield**

Peek, F. W., Jr.

**Swampscott**

Thomson, Elihu.

**Wakefield**

Skinner, H. J.

**Worcester**

Saunders, Louis E.

**MICHIGAN**

**Ann Arbor**

Cooley, M. E.  
Bigelow, S. L.  
Gomberg, Moses.

**Birmingham**

Keller, E. E.

**Detroit**

Berresford, A. W.  
Lawrence, Russell E.  
Morrissey, John P.

**Iron River**

Byers, Isaac W.

**Midland**

Dow, Herbert H.

**MINNESOTA**

**Minneapolis**

Hicks, Thomas W.

**MISSISSIPPI**

**Ocean Springs**

Guthrie, Bayard.

**MISSOURI**

**Kansas City**

Oberle, Alfred.  
Weeks, Edwin R.

**St. Louis**

Caspari, Charles E.  
Dempsey, W. L.  
Garrels, W. L.  
Kinealy, J. H.  
Mallinckrodt, E., Jr.

**NEW HAMPSHIRE**

**Chesham**

Lightfoot, Thomas M.

**Danbury**

Murdock, Joseph B.

**NEW JERSEY**

**Bloomfield**

Shackelford, B. E.

**Bloomingtondale**

Donald, William.

**Bridgeton**

Smith, Oberlin.

**Caldwell**

Potter, Rowland S.

**Camden**

Casselman, William S.  
Fitts, J. Logan.  
Haigia, O. D.  
Kerlin, W. D.  
Kramer, D. F.  
McGowen, J., Jr.  
Ringwalt, Rowland.  
Sauer, Frank H.

**Delanco**

Perkins, G. W.

**Dover**

Canfield, Frederick A.

**Englewood**

Gubelman, F. J.

**Elizabeth**

Pope, Ralph W.

**Gloucester**

Knoedler, E. L.  
Mason, Sidney.  
Miner, Harlan S.  
Ritchie, Kenneth M.

**Haddonfield**

Braddock-Rogers, K.

**Haddon Heights**

Fernandez, G. D.  
Smith, W. A.

**Hammononton**

Cottrell, James W.

**Harrison**

Allan, Andrew, Jr.  
Howell, J. W.

**Hoboken**

Burhorn, Edwin.  
Humphreys, A. C.

**Jersey City**

Holmes, George R.  
Ittner, Martin Hill.

**Laurel Springs**

Andreau, Roland L.

**Maplewood**

Wilson, William.

**Merchantville**

Patterson, Edward B.

**Millville**

Furness, George W.  
Lewis, Daniel C.

**Montclair**

Ellis, Carleton.  
Gesell, William H.  
Loeb, Leo.  
Potter, R. S.  
Steuber, Henry J.

**Moorestown**

Middleton, Albert C.

*New Brunswick*  
Waldron, William H.

*Newark*  
Farrand, Dudley.  
Heitman, Edward.

*Orange*  
Colvin, Fred. H.  
Edison, Thomas A.  
Kilpatrick, J. L.  
Pitman, John.

*Paulsboro*  
Oakleaf, J. F.

*Perth Amboy*  
Roessler, Franz.

*Phillipsburg*  
Caton, John J.

*Plainfield*  
Condict, G. H.

*Princeton*  
Greene, Arthur M.

*Riverton*  
Atlee, Joshua W.  
Biddle, Charles M.  
Flanagan, Charles L.  
Flanagan, Louis A.  
Murray, H. H.  
Randall, H. L.  
Wood, E. S., Jr.

*Secaucus*  
Smith, E. A.

*Sewaren*  
Cowles, Alfred H.

*Short Hills*  
Badenhausen, Carl W.

*Somerville*  
Livingston, Herman.

*Summit*  
Gilpin, Francis H.

*Trenton*  
Porter, H. F.  
Willcox, D.

*Tuckahoe*  
Sloatman, W. S.

*Ventnor*  
Burk, C. A. D.

*Vineland*  
Greene, Joseph F.

*Wildwood Crest*  
King, Charles W. G

## NEW YORK

*Bronxville*  
Waller, Alfred E.

*Brooklyn*  
Colvin, Charles H.  
Colvin, Fred H., and.  
Cowan, Wm. A.  
Davidson, W. F.  
Egleson, J. E. A.  
Foley, A. C., Jr.  
Halsey, Wm. B.  
Hooker, Samuel O.

Bowland, Charles B.  
Sperry, Elmer A.  
Wells, W. F.

*Buffalo*  
Bierbaum, C. H.  
Calkins, G. H.  
Grissinger, Elwood.  
Zilan, Victor W.

*Corning*  
Gage, Henry Phelps.

*Flushing*  
Oatley, H. B.

*Ithaca*

H.

R.

F.  
Jr.

Basford, O. M.  
Bell, J. Snowden.  
Bourne, George L.  
Bradley, A. L.  
Briese, Fritz V.  
Buck, H. W.  
Buckley, O. E.  
Bullock, William E.  
Bunnell, Sterling H.  
Carty, John J.  
Coffin, O. A.

N.

F.

Dubilier, William.  
DuBosque, F. L.  
Dunn, Gano.  
Dyer, F. L.  
Eldred, Byron E.  
Emerson, Harrington.  
Engelhard, Charles.  
Erhart, W. H.  
Falkenau, Arthur.  
Fairchild, Sherman M.  
Finch, Harold H.  
Fries, Harold H.  
Fuller, George W.

J.

Granbery, J.  
Orizwold, Robert G.  
Hallberg, J. H.  
Hammer, Edwin W.

B.

Honaman, R. K.  
Howard, A. C.  
Ives, Herbert E.  
Jackson, John Price.  
Jacobus, D. S.  
Junkersfeld, Peter.

*New York City—Continued*

Kaufmann, H. M.  
Kennedy, J. J.  
Kingsbury, E. F.  
Knox, Henry Hobart.  
Kunz, George F.  
Levy, Max.  
Lewis, Nathan E.  
Lieb, J. W.  
Lieber, Hugo.  
Lindenthal, Gustav.  
Lucas, Francis F.  
Lucke, Charles E.  
Lynch, J. C.  
MacBeth, Norman.  
McKeehan, L.  
Macalpine, J. Kenneth W.  
Mackenzie, K. G.  
Mailloux, C. O.  
Manker, F. W.  
Mayer, Nelson B.  
Merriman, Thaddeus.  
Mershon, Ralph D.  
Metz, Herman A.  
Milner, B. B.  
Moran, Daniel E.  
Muller, R. H.  
Murray, Thomas E.  
Murray, William S.  
Nicholas, William H.  
Orrok, George A.  
Osbourne, L. A.  
Parish, LeGrand.  
Perry, Robert S.  
Pope, Frederick.  
Postlethwaite, C. E.  
Ramsey, George W.  
Ranger, Richard H.  
Rautenstrauch, Walter.  
Reber, Samuel.  
Reno, Jesse W.  
Reoch, Alexander E.  
Richardson, Charles E.  
Ridgway, Robert.  
Roller, Frank W.  
Rooney, Frederick M.  
Rosenbaum, W. A.  
Savage, H. D.  
Schlafge, William.  
Sharp, Clayton H.  
Smith, A. T.  
Smith, Frank W.  
Smith, J. Waldo.  
Snare, F.  
Snook, H. Clyde.  
Southall, James P. C.  
Spicer, H. N.  
Sprague, Frank J.  
Sprong, S. D.  
Stillwell, Lewis B.  
Teeple, John E.  
Tikhonovitch, Benedict.  
Toch, Maximilian.  
Torchio, Philip.  
Underwood, Frederick D.  
Van Deventer, H. R.  
Vreeland, Frederick K.  
Waddell, J. A. L.  
Wadleigh, F. R.  
Wallerstein, Leo.  
Webster, Albert L.  
Weiss, J. M.  
Woodhouse, Henry.  
Wright, Roy V.  
York, H. W.  
Yorke, George M.  
Zehnder, Charles H.

*Niagara Falls*

Fitzgerald, Francis A. J.  
Lidbury, F. A.

*Port Washington*

MacLean, George.

*Rochester*

Nichols, E. B.  
Poser, M.  
Saegmuller, G. N.

*Rye*

Robinson, Dwight.  
St. John, Ancel.

*Scarsdale*

Atwater, R. M., Jr.

*Schenectady*

Andrews, W. S.  
Berg, Ernst J.  
Berg, P. Eskil.  
Capp, John A.  
Hoadley, Anthony DeH.  
Kellers, Charles.  
Keith, C. P.  
Lichtenberg, Chester.  
Lovejoy, J. R.  
Rice, E. W.  
Stevenson, Alexander R.  
Stone, C. W.  
Trench, W. W.  
Vaughen, F. G.  
Vogdes, Francis B.

*Syracuse*

Fryer, George G.

*Tarrytown*

Whyte, F. M.

*Troy*

Caird, James M.  
Mason, W. P.

*Voorheesville*

Horton, Robert S.

*Warwick*

Hitchcock, Fanny R.

*Yonkers-on-Hudson*

Baekeland, L. H.

NORTH CAROLINA

*Arden*

Rumbough, John B.

OHIO

*Akron*

Jones, Philip C.

*Cincinnati*

Freeman, W. W.  
Lloyd, John Uri.  
Muller, E. A.  
Viall, Ethan.

*Cleveland*

Abbott, Robert R.  
Cox, J. D.  
Doane, Samuel E.  
Gfroerer, A. H.  
Jefferies, Zay.  
Karrer, Enoch.  
Lihme, I. P.  
Lucklesh, M.  
MacBain, D. R.  
Oetting, O. W. A.  
Smith, Albert W.

*Columbus*

Smith, Iowa.  
Stout, Orin C.

*Dayton*

Ohmer, Will I.  
Tait, Frank M.  
Toulmin, H. A.  
Wright, Orville.

*Middletown*

Eppelshimer, Daniel.

*Worthington*

Fitz, E. M.

## OKLAHOMA

*Ponca City*

Eckhardt, E. A.

## OREGON

*Grants Pass*

Canby, William W.

*Portland*

Bilyeu, Thomas.

## PENNSYLVANIA

*Abington*

Merritt, James Smith.

*Allentown*

Trexler, Harry O.  
Snelling, Walter O.

*Altoona*

Pease, F. N.

*Ambler*

Hagar, Walter F.  
Smith, Irving B.

*Ardmore*

Erne, Alfred.  
Kent, A. Atwater.  
Sellers, Horace W.  
Snyder, Monroe B.  
Worrell, Howard S.

*Bellevue*

Lower, Nathan M.

*Bethayres*

Lippincott, Joseph W.

*Bethlehem*

Ford, Terrance.  
Kinnier, G. E.  
Rau, Albert George.  
Richards, C. R.  
Wilbur, W. A.

*Bryn Athyn*

Boericke, Felix A.  
Howard, Wilfred.  
Synnestvedt, Arthur.

*Bryn Mawr*

Barnes, James.  
Crenshaw, James L.  
Ferree, Clarence Errol.  
Horn, David W.  
Schlacks, C. H.  
Smith, W. Hinckle.  
Townsend, J. W.  
Vaux, George, Jr.  
Wood, Allen, 3rd.

*Bristol*

Hollander, Charles S.  
Nielson, D.

*Brookline*

Holst, L. J. R.

*Butler*

Christianson, A.

*Burnham*

Skinner, O. C.

*Chester*

Hart, Charles.

Kucher, A. A.

Palmer, T. Chalkley.

Palmer, Walter.

Shattuck, John D.

Stevenson, S. Price.

Wetherill, Robert.

Woodbury, C. A.

*Chester Heights*

Moore, Horace E.

*Clearfield*

Graham, W. F.

*Coatesville*

Ridgway, Ellis B.  
Ridgway, William H.

*Collegeville*

Olamer, F. J.  
Tyson, H. P.

*Conshohocken*

Wood, Biddle.

*Cynwyd*

Haupt, Lewis M.

*Darling*

Willcox, W. F.

*Devon*

Bright, John Irwin.  
Dolan, Thomas J.  
Walker, J. W.  
Welsh, Francis Ralston.

*Easton*

Brown, G. S.  
Cornelius, Edward.  
Hart, Edward.  
Raymond, Ward.  
Shimer, Porter W.  
Wilson, J. Hunt.

*Egypt Mills*

Spackman, H. S.

*Elkins Park*

Lamb, Newton.

*Elwood City*

Brownstein, Benjamin.

*Erdenheim*

Wood, Robert L.

*Erie*

Durban, Thomas E.

*Franklin*

Rhoades, Joseph J.

*Glenolden*

Nicholas, Leon W.

*Greenburg*

Donohoe, John P.

*Harrisburg*

Irons, Robert H.  
Masters, Frank M.

*Haverford*

Curwen, Samuel M.  
Evans, H. C.  
Felton, E. C.  
Klemm, J. G., Jr.  
Lewis, Wilfred.  
Lohmann, A. P.  
Measey, William Paul.  
Moore, Coleman B.  
Morris, A. Saunders.  
Palmer, Frederick.  
Robinson, Anthony W.  
Sawtelle, William Otis.  
Woolman, Edward.

*Hazleton*

Markle, A.  
Stevenson, Royal B.

**Highland Park**

Birch, George W.

**Irwin**

Miles, J. Walter.

**Jenkintown**

Benson, George H., Jr.

Gibson, Henry Clay.

Keller, H. H.

Newbold, C. B., Jr.

**Johnstown**

Crichton, Andrew B.

**Kennett Square**

Phillips, Edwin S.

**Lancaster**

Adams, B. F.

Widmyer, J. H.

T.

L.

J.

, 3rd.

Walker.

**Media**

Bell, J. P.

Trautwine, John C., 3rd.

Wilson, J. L.

**Melrose Park**

Brown.

**Merion**

Boericke, John J.

Davis, R. W.

Eglin, A. O., Jr.

Shand, A. C.

**Millbourne**

Sellers, Howard.

**Millersville**

Davidhiser, Lee.

**Minersville**

Snyder, Clinton F.

**Moylan**

Sanderson, R. P. C.

**Narberth**

Bates, O. W.

**Natrona**

Huff, Ernest L.

**New Castle**

Kirk, O. J.

**New Hope**

Miller, Fred. J.

**Norristown**

Place, Samuel.

**Paoli**

Smith, P. F., Jr.

**Parkburg**

Beale, Horace A., Jr.

E.

**Philadelphia**

Abrams, Peter.

Aersten, G.

Aiken, Frank.

Akerlow, G. W.

Akimoff, Nicholas W.

Albrecht, A. O.

Albrecht, Herman C.

Allen, Arthur H., Jr.

Allen, Henry B.

Allen, William N.

Anderson, Cyrus N.

Armstrong, William R.

Ashhurst, John.

Ashworth, H.

Atterbury, W. W.

Austin, W. L.

Ayers, Eugene E.

Bache, Daniel.

Baker, George F.

Balch, Alfred C.

Balch, E. S.

E.

D.

Blair, A. A.

Blum, Arthur N.

Bodine, S. T.

Boekel, J.

Bonine, Charles E.

Boon, H. O.

Borie, Beauveau.

Borton, George W.

Bowen, Samuel B.

L.

tarr.

mk.

Jr.

H.

Capp, S. Bunker.

Card, P. Q.

Chambers, Francis T.

Chambers, J. Howard.

Chance, E. M.

Chance, H. M.

Chandler, T. P.

Charlton, Richard C.

Chesterman, Francis T.

Church, Arthur L.

Clamer, G. H.



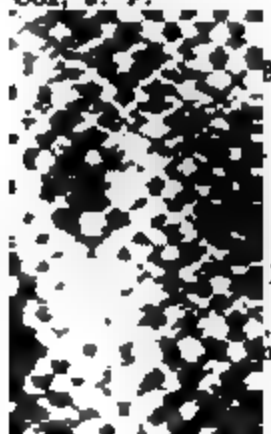
## Philadelphia—Continued

Clark, A. Wayne.  
Clark, Beauvais.  
Clark, Darthela.  
Clark, E. W.  
Clark, Edward L.  
Clark, Joseph S.  
Clark, Theobald F.  
Clark, Walton.  
Clark, Mrs. Walton.

Jr.  
L.

H.  
Reed.  
H.  
F.

Cooke, Morris L.  
Cope, Thomas D.  
Cornelius, Clarence.  
Cornelius, J. C.  
Cox, J. F.



3rd.  
man.

Dobson, William A.

L.

Eglin, W. C. L.  
Ehrenfeld, Frederick.  
Ehret, O. D.  
Elcock, John J.  
Elkins, George W.

W.  
W.

Jr.

Evans, O. B.  
Evans, Powell.

S.  
Jr.  
ley.  
ick C.

Flore, Andrew  
Fisher, Thomas

Fitzmaurice, William J., Jr.  
Fleisher, B. W.  
Fletcher, W. E.  
Ford, Bruce.  
Forstall, Walton.  
Francis, Isaac H.

H.

Faguet, H.  
Fulweiler, W. H.

Garrison, F. Lynwood.  
Gartley, William H.  
Gazam, J. M.  
Gerhard, Arthur Howell.  
Gest, William P.  
Gibbs, A. E.  
Gibbs, W. S.  
Gill, John D.  
Gillman, F. W.

E.

L.

Griest, Thomas H.  
Grosscup, H. A.  
Gucker, F. T.  
Haines, Casper Wistar.  
Haines, Robert B., Jr.  
Haines, William A.  
Hall, O. A.

R.

Harrison, A. C.  
Harrison, C. C.  
Harrison, G. L.  
Harrison, J. K. M.  
Harrison, Thomas R.  
Harrison, W. W.  
Hartung, Adolph.  
Hartzel, Francis W.  
Hawood, Nathan

ncis.

Houston, Samuel F.  
Howe, Arthur W.  
Howson, Charles Henry.

## Philadelphia—Continued

- Howson, Henry.  
 Howson, Richard.  
 Hummell, Willard A.  
 Hutchinson, S. Pemberton.  
 Indahl, Mauritz C.  
 Ingersoll, Charles E.  
 Irish, W. M.  
 Israel, Joseph D.  
 Ives, Fred S.  
 Jackson, William Steell.  
 James, William Fry.  
 Jeanes, Isaac W.  
 Jenkins, Theodore F.  
 Jennings, W. N.  
 Johnson, C. N.  
 Johnson, Ernest.  
 Johnson, J. C.  
 Johnson, W. H.  
 Johnson, William A.  
 Jones, Julian D.  
 Justi, Henry M.  
 Kabakjian, D. H.  
 Kaltenthaler, H. J.  
 Kavanaugh, William H.  
 Kelly, George L.  
 Kellog, Hosford D.  
 Kennedy, Frank G.  
 Kennedy, M. O.  
 Kent, S. Leonard, Jr.  
 Kercher, M. A.  
 Kerr, William M.  
 Ketcham, O. W.  
 Ketterlinus, J. L.  
 Kimber, W. M. C.  
 King, Joseph B., Jr.  
 Kinnard, L. H.  
 Kirsoff, E. C. B.  
 Klauder, R.  
 Kline, C. M.  
 Klumpp, John Bartleman.  
 Knapp, Arthur.  
 Kneass, Strickland L.  
 Kohn, Joseph.  
 Kraus, C. R.  
 Kuehn, T.  
 Kuhn, C. Hartman.  
 Landreth, C. P.  
 Lanza, G.  
 Lauer, Conrad.  
 Lavino, E. J.  
 LaWall, Charles H.  
 Lay, John Tracy.  
 Ledoux, J. W.  
 Lee, Elisha.  
 Lee, James D.  
 Lee, Walter T.  
 Leeds, Morris E.  
 Leffmann, Henry.  
 Leighninger, William B.  
 LeMaistre, F. J.  
 Lemoine, L. R.  
 Lesley, Robert W.  
 Levy, Howard S.  
 Levy, Lionel F.  
 Lewis, A. Nelson.  
 Lewis, Howard W.  
 Lewis, John F.  
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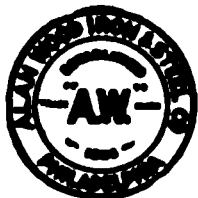
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CRESSON, JOHN C., 1855-1863	SELLERS, WILLIAM, 1864-1866
EGLIN, WM. C. L., 1924-	TATHAM, WILLIAM P., 1879-1885
MERRICK, J. VAUGHAN, 1867-1869	WILSON, JOSEPH M., 1887-1896
MERRICK, SAMUEL V., 1842-1854	

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BALDWIN, MATTHIAS W., 1855-1863	JONES, WASHINGTON, 1900-1910
BECK, PAUL, JR., 1826-1827	LEVY, LOUIS E., 1916-1919
BULLOCK, CHARLES, 1879-1900	LONGSTRETH, EDWARD, 1890-1894
CAREY, MATTHEW, 1824-1828	LUKENS, ISAIAH, 1824-1825, 1829-1846
CARTWRIGHT, HENRY, 1880-1881	MILLER, ABRAHAM, 1847-1854
CHRISTIE, JAMES, 1911	MITCHELL, J. E., 1875-1887
CLOSE, CHARLES S., 1875-1879	MOORE, BLOOMFIELD H., 1869-1876
CRESSON, GEORGE V., 1898-1903	MORRIS, HENRY G., 1870-1879
DAY, CHARLES, 1920-1923	RAND, THEODORE D., 1897-1903
DODGE, JAMES MAPES, 1903-1915	ROGERS, FAIRMAN, 1864-1866
EGLIN, WM. C. L., 1922-1923	ROGERS, ROBERT E., 1868-1874
EREBY, GEORGE, 1867	SELLERS, COLEMAN, 1867-1869
FLETCHER, THOMAS, 1828-1850, 1852-1854	SELLERS, COLEMAN, JR., 1912-1922
FORSTALL, WALTON, 1926-	TATHAM, WILLIAM P., 1888-1897
FRAZER, JOHN F., 1865-1866	TOWNE, JOHN H., 1864-1868
GRAFF, FREDERICK, 1882-1890	TUTWILER, C. C., 1924-

## RECORDING SECRETARIES

BULKLEY, JAMES H., 1831-1832	PEROT, WILLIAM S., 1833-1834
GARRIGUES, ISAAC B., 1830, 1837-1863	ROBERTS, ALGERNON S., 1829
JONES, THOMAS P., 1827-1828	STRICKLAND, WILLIAM, 1824-1826
JONES, WASHINGTON, 1864	TRAUTWINE, JOHN C., 1835-1836

**CORRESPONDING SECRETARIES**

BACHE, ALEX. DALLAS, 1840-1844

BRIGGS, ROBERT, 1864

BROWNE, PETER A., 1824-1827

CRESSON, JOHN C., 1854

FRALEY, FREDERICK, 1855-1863

FRAZER, JOHN F., 1845-1847

HAYS, ISAAC, 1828-1839

ROBERTS, SOLOMON W., 1848-1853

**SECRETARIES**

CHRISTIE, JAMES, 1909

HOADLEY, GEORGE A. (Acting), 1917-  
1918, 1924-1925

KNIGHT, J. B., 1875-1879

McCLENAHAN, HOWARD, 1925-

MORTON, HENRY, 1865-1870

NORRIS, ISAAC, 1879-1881

OWENS, ROBERT B., 1910-1924

WAHL, WILLIAM H., 1871-1874, 1882-  
1908**TREASURERS**

BORGNER, CYRUS, 1908-1920

FLETCHER, THOMAS, 1824-1825

FRALEY, FREDERICK, 1830-1847, 1865-  
1882

FRANKLIN, BENJAMIN, 1920-

FRAZER, JOHN F., 1848-1864

MERRICK, SAMUEL V., 1828-1829

RICHARDSON, JOHN, 1826-1827

SARTAIN, SAMUEL, 1883-1906

TREGO, CHARLES B., 1847

WAHL, WILLIAM H., 1907

**ACTUARIES**CHRISTIE, JAMES, Feb. 21-June 11,  
1908

HAMILTON, WILLIAM, 1828-1871

HEYL, HERBERT L., 1885-1908

HOLMAN, DAVID S., 1872-1885

JACKSON, WILLIAM F., JR., 1924-1925

JESTER, SIMEON VAN T., 1916-1918

LARZELERE, JAMES S., 1908-1916

PARRISH, T. R., 1922-1924

ROBINSON, LOUIS C., 1918-1922

WAHL, WILLIAM H., 1872

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JACKSON, WILLIAM F., JR., 1925-

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ABBOT, WILLIAM, 1824-1826

ADAMSON, WILLIAM, 1864

ADDICKS, JOHN E., 1845-1850

AGNEW, JOHN, 1831-1850, 1852-1854

ALLEMAN, GELLERT, 1918-1923

ALLEN, JAMES, 1845

ALLISON, WILLIAM C., 1863

ARCHER, ELLIS S., 1858-1859

BACHE, ALEX. DALLAS, 1830-1839

BALCH, EDWIN S., 1902-1912

BALDWIN, MATTHIAS W., 1827-1854

BANES, CHARLES H., 1877-1885, 1887-  
1895

BARKER, GEORGE F., 1874-1875

## MANAGERS—(Continued)

BARNES, JAMES, 1925-	CHESTERMAN, FRANCIS J., 1926
BARRAS, JOSEPH J., 1851-1860	CHRISTIE, JAMES, 1897-1908
BARTOL, BARNABAS H., 1863-1865	CLAMER, G. H., 1917-
BARTOL, HENRY W., 1870-1878	CLARK, THEOBALD F., 1917-
BAUGH, DANIEL, 1900-1902	CLARK, WALTON, 1903-1906, 1924-
BAUGH, HARMAN, 1855	CLARKE, JAMES, 1824-1826
BEALE, JOSEPH, 1827	CLOSE, CHARLES S., 1865-1874
BEARDSLEY, ARTHUR, 1894-1902	CLOUD, JOSEPH, 1824
BECK, PAUL, JR., 1824-1825	CODMAN, JOHN E., 1892-1894
BEMENT, CLARENCE S., 1871	COLLINS, ISAAC, 1828
BEMENT, WILLIAM B., 1866-1870	CONARD, THOMAS P., 1894-1908
BENZON, GEORGE H., JR., 1925-	CONARROE, GEORGE W., 1851-1863
BERGNER, THEODORE, 1870-1875	COOPER, JOHN H., 1870-1873
BETTS, WILLIAM C., 1844	COPPER, JOHN C., 1851
BIDDLE, CLEMENT C., 1824	CORNELIUS, ROBERT, 1855-1863
BILGRAM, HUGO, 1885-1890	CORNELIUS, ROBERT C., 1866-1868
BIRKBECK, JOHN, 1869-1871	CRAMP, CHARLES H., 1864-1867, 1875, 1895-1897
BIRKINBINE, HENRY P. M., 1851-1856	CRESSON, GEORGE V., 1886-1897
BIRKINBINE, JOHN, 1907-1915	CRESSON, JOHN C., 1835-1853
BOLTON, JAMES M., 1830	CRESSON, WILLIAM P., 1848-1849
BONINE, CHARLES E., 1921-	DARRACH, CHARLES G., 1894-1896
BORGNER, CYRUS, 1903-1907	DAY, CHARLES, 1908-1919, 1924-
BOSWELL, WILLIAM L., 1896-1898	DIVINE, WILLIAM, 1864
BOWER, HENRY, 1891-1896	DODGE, JAMES MAPES, 1896-1903
BRIGGS, ROBERT, 1867-1873	DODGE, KERN, 1916-1920
BROCK, ROBERT C. H., 1901-1906	DONALDSON, JOSEPH, 1825
BROLASKY, HENRY C., 1897-1902	DOUGHERTY, JAMES, 1858-1861
BRYSON, JAMES H., 1857-1863	DRAPER, EDMUND, 1847-1850
BUDD, EDWARD G., 1927-	DREER, FERDINAND J., 1862
BULKLEY, JAMES H., 1830, 1833-1841	DROWN, WILLIAM A., 1861-1863
BULLOCK, CHARLES, 1868-1878	DU BOIS, WILLIAM L., 1880-1882
BURNHAM, GEORGE, 1878	DURFEE, WILLIAM F., 1872-1873
BURTIS, AARON H., 1845	EASTWICK, ANDREW M., 1836-1844
CARR, WILLIAM H., 1837-1845	EASTWICK, EDWARD P., 1859-1860
CARTWRIGHT, HENRY, 1865-1879	EBERT, MORRIS, 1908-1911
CHABOT, CYPRIEN, 1877-1889	ECKERT, GEORGE M., 1852-1854
CHAMBERS, CYRUS, JR., 1876-1890	EGLIN, WM. C. L., 1908-1922
CHAMBERS, FRANCIS T., 1913-	EISENHUT, JOHN D., 1824-1825
CHASE, PLINY E., 1864-1886	

## MANAGERS—(Continued)

- ELDRIDGE, G. MORGAN, 1885-1890  
 ELLIS, JAMES P., 1848-1851  
 EMERSON, G., 1828  
 EREBY, GEORGE, 1854-1866  
 EVANS, OWEN, 1844-1857  
 FERGUSON, ALEXANDER, 1831-1841  
 FLETCHER, THOMAS, 1826-1827  
 FLING, WILLIAM B., 1842  
 FORSTALL, WALTON, 1908-1925  
 FOX, GEORGE, 1828-1830  
 FRALEY, FREDERICK, 1829, 1848-1854  
 FRANKLIN, BENJAMIN, 1917-1919  
 FRAZER, JOHN F., 1844, 1865-1866  
 FRAZER, PERSIFOR, 1880-1891, 1903-1909  
 FRAZIER, GEORGE H., 1898  
 FRENCH, HOWARD B., 1900  
 FRY, WILLIAM, 1825  
 GARDINER, JOHN, JR., 1864  
 GARRIGUES, ISAAC B., 1825-1829, 1831-1836  
 GARRISON, F. LYNWOOD, 1890-1895, 1897-1903  
 GAWTHROP, HENRY, 1896-1898  
 GIBBS, ALFRED W., 1915-1922  
 GIBSON, J. HOWARD, 1893-1894  
 GIBSON, JOHN J., 1912-1915  
 GILDER, JOHN, 1838-1841  
 GILPIN, THOMAS, 1824  
 GOBRECHT, CHRISTIAN, 1828-1830  
 GOLDSMITH, E., 1908-1916  
 GOODSPEED, ARTHUR W., 1925-  
 GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881  
 GRAHAM, HOWARD S., 1920-1921  
 GREBLE, EDWIN, 1841-1863  
 GREENE, STEPHEN, 1898-1908  
 GRIES, JOHN M., 1858-1862  
 GRIFFITH, R. EGGLESFIELD, 1870-1871  
 GRIFFITH, ROBERT E., 1827  
 GROVES, DANIEL, 1824-1827  
 HALL, CLARENCE A., 1922-  
 HAND, JAMES C., 1845-1846  
 HANSELL, WILLIAM S., 1827  
 HARDING, GEORGE, 1864-1865  
 HARKER, JOSHUA G., 1831-1836  
 HARPER, JAMES, 1824-1826  
 HARRIS, WILLIAM, 1860-1863  
 HARRISON, ALFRED C., 1895-  
 HARRISON, C. LELAND, 1899-1902  
 HARRISON, JOHN, 1824-1829  
 HARRISON, JOSEPH, JR., 1854, 1856-1859  
 HART, SAMUEL, 1865-1870  
 HAVILAND, JOHN, 1824-1826  
 HAYS, ISAAC, 1840-1841  
 HAYWARD, NATHAN, 1917-  
 HELLER, CHARLES S., 1879-1880  
 HELME, WILLIAM, 1869-1888  
 HENDERSON, GEORGE R., 1915-1921  
 HERSE, GEORGE P., 1851  
 HEXAMER, CHARLES A., 1904-1925  
 HEYL, HENRY R., 1879-1895, 1898-1909  
 HOADLEY, GEORGE A., 1911-  
 HORN, HENRY, 1824  
 HORSTMANN, WILLIAM J., 1865-1868  
 HOUSTON, EDWIN J., 1874-1897  
 HOWARD, GEORGE C., 1855-1858  
 HOWE, HERBERT M., 1898-1900  
 HOWSON, CHARLES HENRY, 1903-1907  
 HOWSON, HENRY, 1898-1903  
 HUFTY, SAMUEL, 1834-1850  
 HUMPHREYS, SAMUEL, 1826  
 HUNTER, JAMES, 1864  
 HUTCHINSON, CHARLES H., 1888-1890  
 HUTCHINSON, JAMES, 1841-1842  
 HUTCHINSON, JOSEPH, 1860-1863  
 JAYNE, HARRY W., 1891-1910

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JENNINGS, W. N., 1896	McCAFFREY, E. V., 1910-1924
JOHNSON, LAWRENCE, 1855-1859	McCAMBRIDGE, RICHARD, 1876
JONES, THOMAS P., 1826	McCLURE, JOHN, 1853-1856
JONES, WASHINGTON, 1859-1895, 1897-1900	McCLURG, ALEXANDER, 1833-1839
KATEZ, I., 1824	McEUEEN, THOMAS, 1829
KEATING, WILLIAM H., 1824-1826, 1830-1840	McKEAN, WILLIAM V., 1879-1883
KELLER, HARRY F., 1914-1924	MARKS, WILLIAM D., 1881-1884
KELLY, HENRY H., 1851	MARSHALL, SAMUEL R., 1887-1893
KING, ROBERT P., 1851	MASON, DAVID H., 1824
KIRK, CHARLES H., 1830	MASON, JAMES S., 1861
KIRKPATRICK, GEORGE E., 1911-1914	MEGARGEE, CHARLES, 1858
KLUMPP, JOHN BARTLEMAN, 1923	MEIRS, RICHARD WALN, 1908-1917
KNEASS, WILLIAM, 1825	MERRICK, J. VAUGHAN, 1864-1866, 1870-1884
KNIGHT, DANIEL R., 1845	MERRICK, SAMUEL V., 1824-1827, 1830-1841, 1855-1863
KRUMBHAAR, ALEXANDER, 1898-1911	MIFFLIN, LLOYD, 1825-1826
KUHN, C. HARTMAN, 1896-1905	MILES, FREDERICK B., 1874
LAMBERT, WM. H., 1906	MILLER, ABRAHAM, 1824-1846, 1855-1858
LESLEY, ROBERT W., 1913-	MITCHELL, J. E., 1874
LE VAN, W. BARNET, 1864-1876	MITCHELL, WILLIAM A., 1864-1865
LEVY, LOUIS E., 1903-1915	MOORE, BLOOMFIELD H., 1864-1868
LEWIS, ENOCH, 1868-1894	MOORE, JOSEPH W., 1860-1861
LEWIS, HARVEY, 1824-1827	MORGAN, MARSHALL S., 1914-
LEWIS, MORDECAI D., 1828-1836	MORRIS, ELWOOD, 1844-1847
LINDSAY, JOHN, 1843	MORRIS, HENRY G., 1864-1869
LINDSAY, ROBERT, 1834-1836	MORRIS, ISAAC P., 1836-1843
LINNARD, JAMES M., 1836-1838	MORRIS, WILLIAM E., 1847-1851
LINVILLE, J. HAYES, 1868	MUCKLE, M. RICHARDS, JR., 1894-1896
LONGSTRETH, CHARLES, 1903-1907	NAYLOR, JACOB, 1863, 1865-1872
LONGSTRETH, EDWARD, 1868-1870, 1895-1897	NEAFIE, JACOB G., 1868
LOUD, THOMAS, 1829-1831	NEWHALL, PAUL W., 1843-1844
LOVE, WILLIAM H., 1859	NORRIS, ISAAC, 1870-1878, 1883-1918
LUCAS, JOHN, 1888-1894	NYSTROM, JOHN W., 1873-1875
LUKENS, ISAIAH, 1828	OGDEN, JOHN M., 1833
LUKENS, JAWOOD, 1902-1908	OGLE, WILLIAMS, 1845-1850
LYMAN, BENJAMIN S., 1901-1902	O'NEILL, JOHN, 1827-1832
McALPINE, JAMES, 1825-1828	ORR, HECTOR, 1871-1887

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- OUTERBRIDGE, ALEX. E., JR., 1881-1886  
 PALMER, B. FRANKLIN, 1862  
 PARRISH, WILLIAM D., 1838, 1852-1854  
 PARRY, CHARLES T., 1864  
 PATTERSON, ROBERT, 1824  
 PATTERSON, ROBERT M., 1825-1827  
 PAUL, LAWRENCE T., 1895-1926  
 PEMBERTON, HENRY, JR., 1891-1896  
 PENROSE, CHARLES, 1925-  
 PERRY, ROBERT S., 1912-1916  
 PETTIT, HORACE, 1894-1910  
 PURVES, ALEXANDER, 1875-1876  
 RALSTON, ASHBEL G., 1825-1830  
 RAMAGE, ADAM, 1824-1832  
 RAND, THEODORE D., 1874-1897  
 REED, WILLIAM B., 1832-1836  
 REEVES, BENJAMIN, 1829-1837  
 REEVES, SAMUEL J., 1864  
 REEVES, STACY, 1889-1902  
 RICE, JOHN, 1866-1867  
 RICHARDS, MARK, 1831  
 RICHARDSON, JOHN, 1825  
 RIEHLE, HENRY J., 1826-1827  
 ROBBINS, SAMUEL J., 1827-1833  
 ROBERTS, ALGERNON S., 1828  
 ROBERTS, PERCIVAL, 1864-1868  
 ROBERTS, SOLOMON W., 1842-1847  
 ROBINSON, ALEXANDER P., 1911-1916  
 ROGERS, EVANS, 1854-1863  
 ROGERS, HENRY D., 1838-1843  
 ROGERS, JAMES S., 1909-  
 ROGERS, ROBERT E., 1867  
 RONALDSON, CHARLES E., 1885-1893, 1908-1912  
 ROSENGARTEN, GEORGE D., 1912-  
 ROWLAND, JAMES, JR., 1829-1830  
 ROWLAND, WILLIAM, 1828  
 RUSH, WILLIAM, 1825  
 RUST, JAMES I., 1824  
 SADTLER, SAMUEL P., 1888-1897  
 SANBORN, E. H., 1907-  
 SARTAIN, JOHN, 1877-1879  
 SARTAIN, SAMUEL, 1865-1882  
 SAVERY, PELEG B., 1851-1852  
 SAXTON, JOSEPH, 1842-1844  
 SAY, BENJAMIN, 1832-1833  
 SCATTERGOOD, THOMAS, 1829-1834  
 SCHAUM, OTTO W., 1907  
 SCHREINER, JOSEPH H., 1827-1832  
 SCHUMANN, FRANCIS, 1899-1902  
 SEIPER, THOMAS, 1824  
 SELLERS, COLEMAN, 1862-1866, 1875-1905  
 SELLERS, COLEMAN, JR., 1906-1911  
 SELLERS, WILLIAM, 1857-1861, 1867-1892  
 SHAIN, CHARLES J., 1884-1887  
 SHINN, EARLE, 1836-1837  
 SLOAN, SAMUEL, 1864  
 SMITH, CHARLES E., 1852-1855  
 SMITH, HASELTINE, 1922-  
 SOUDER, JACOB, 1828  
 SPANGLER, HENRY W., 1891-1893  
 STEVENSON, WILLIAM, JR., 1828  
 STEWART, THOMAS S., 1842-1850, 1852-1863  
 STRICKLAND, WILLIAM, 1828  
 STRUTHERS, JOHN, 1827-1849  
 TABER, GEORGE, 1839-1842  
 TATHAM, WILLIAM P., 1870-1878, 1886-1887  
 THOMPSON, AMBROSE W., 1839-1843  
 THOMSON, ELIHU, 1878-1881  
 THORNE, WILLIAM H., 1881-1897  
 THORNLEY, JOHN, 1851  
 TILGHMAN, BENJ. C., 1871-1875  
 TOPPAN, CHARLES, 1831-1832

## MANAGERS—(Continued)

- TOWNE, JOHN H., 1840-1857, 1869  
 TOWNSEND, EDWARD Y., 1866-1867  
 TRACY, ELIASHIB, 1851  
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857  
 TRAUTWINE, JOHN C., JR., 1891-1895  
 TREGO, CHARLES B., 1837-1846  
 TREVOR, JOHN B., 1832  
 TROTH, HENRY, 1837-1841  
 TRYSON, GEORGE W., 1831-1833  
 TUTWILER, C. C., 1920-1923  
 TYLER, RUFUS, 1826-1837  
 VAUCLAIN, SAMUEL M., 1898, 1906  
 VAUX, GEORGE, JR., 1898-1899  
 WAGNER, SAMUEL T., 1927-  
 WALLIS, J. T., 1923-  
 WALTER, JOSEPH S., JR., 1834-1837  
 WALTER, THOMAS U., 1829-1831, 1840-1851  
 WARDER, WILLIAM S., 1825-1827  
 WARNER, JOHN S., 1837-1843  
 WEAVER, JACOB, 1856-1857  
 WEAVER, JOHN J., 1880-1891  
 WEIGHTMAN, WILLIAM, 1862-1863  
 WETHERILL, CHARLES, 1835  
 WETHERILL, J. P., 1902  
 WETHERILL, JOHN P., 1824-1825  
 WETHERILL, WILLIAM, 1832  
 WETHERILL, WILLIAM C., 1916-  
 WEYGANDT, THOMAS J., 1851-1863  
 WHARTON, WILLIAM, JR., 1871  
 WHITAKER, GEORGE P., 1851-1852  
 WHITE, CHARLES H., 1828-1835  
 WHITE, SAMUEL S., 1864-1867  
 WHITNEY, ASA, 1846-1850  
 WHITNEY, GEORGE, 1858-1860  
 WHITNEY, JAMES S., 1862-1863, 1865-1869  
 WHITNEY, JOHN R., 1861  
 WICKHAM, M. T., 1824  
 WIEGAND, JOHN, 1831-1853  
 WIEGAND, S. LLOYD, 1864, 1890-1893  
 WILLIAMS, EDWARD H., 1871-1872  
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863  
 WILSON, JOSEPH M., 1869-1886  
 WILSON, O. HOWARD, 1864-1869  
 WOLBORN, CORNELIUS A., 1844-1850  
 WOLF, OTTO C., 1897-1913  
 WOOD, ALAN, 1845-1863  
 WOOD, SAMUEL R., 1824-1825  
 WOOD, WALTER, 1903-1912  
 WOOTTEN, JOHN E., 1860-1862  
 YARDLEY, WILLIAM, JR., 1829  
 YEAGER, JOSEPH, 1832  
 YOUNG, ANDREW, 1828-1830



## PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS, 1834-1927

BACHE, ALEXANDER D., 1834-1836, 1839-1844	HOADLEY, GEORGE A., 1911-1912
BARNES, JAMES, 1922-1923	KOENIG, G. A., 1888-1889
BEARDSLEY, ARTHUR, 1892-1895	LEVY, LOUIS E., 1901-1902
BENZON, GEORGE H., JR., 1924-1925	LEWIS, WILFRED, 1912-1913
BILGRAM, HUGO, 1906-1907	MARBURG, EDGAR, 1899-1900
BONINE, CHARLES E., 1916-1917	MARKS, W. D., 1881-1882, 1887-1888
CALVERT, HAROLD, 1925-1926	MASLAND, CHARLES W., 1921-1922
CHRISTIE, JAMES, 1897-1898	MCCONNELL, JACOB Y., 1909-1910
CLAMER, G. H., 1915-1916	ORR, HECTOR, 1880-1881
CONARD, THOMAS P., 1902-1903	PATTERSON, R. M., 1836-1839
CREIGHTON, H. JERMAIN, 1918-1919	PENROSE, CHARLES, 1920-1921
CRESSON, J. C., 1844-1874	PRICE, M. M., 1927-
CRISFIELD, J. A. P., 1913-1914	ROGERS, JAMES S., 1908-1909
ELDRIDGE, G. MORGAN, 1896-1897	RONALDSON, CHARLES E., 1903-1904
FRANKLIN, BENJAMIN, 1919-1920	RONDINELLA, L. F., 1898-1899
FULWEILER, W. H., 1923-1924	SARTAIN, SAMUEL, 1895-1896
GOLDSMITH, EDWARD, 1905-1906	SELLERS, COLEMAN, 1875-1880
GRIGGS, WILLIAM O., 1907-1908	SPANGLER, H. W., 1890-1891
HALL, CLARENCE A., 1926-1927	SPENCER, THOMAS, 1910-1911
HAUPT, LEWIS M., 1904-1905	WETHERILL, WM. CHATTIN, 1917-1918
HENDERSON, GEORGE R., 1914-1915	WIEGAND, S. LLOYD, 1889-1890, 1891- 1892
HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901	

## THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere.

### THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading-room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of Switzerland since 1888, of the United States since 1790. The specifications of French patents 1791 to 1900 and abstracts of the patents

granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from states and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic efforts to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 85,200 volumes and 25,600 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing the investigations.

The library is open daily from 9 o'clock A.M., until 5 o'clock P.M., Saturdays twelve o'clock noon. The Institute is closed on all state and national holidays.

### THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

### THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Doctor Jones, after he had received assurances of active coöperation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

### THE FRANKLIN JOURNAL AND MECHANICS' MAGAZINE, UNDER THE PATRONAGE OF

THE FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE  
MECHANIC ARTS, EDITED BY DR. THOMAS P. JONES, PROFESSOR OF  
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Doctor Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 203 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive. The fourth decennial index 1916-1925, is in preparation and will be published shortly.

In its present form, the JOURNAL is an octavo of about 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

## INSTRUCTION

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824, and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages." This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned.

The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-nine years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its school has been suspended.

### LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically preëmpted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation, The Franklin Institute, has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

### **THE JAMES MAPES DODGE LECTURE FOUNDATION**

The James Mapes Dodge Lecture Foundation was established by Mrs. James Mapes Dodge as a memorial to her late husband, who was for a long time a member of the Institute, and for fifteen years a Vice-President. The Foundation permits the Institute to maintain the Christmas Week Lectures for young people which were inaugurated in December, 1926. These lectures are of a quality suited for young people of high school or preparatory school age. They are to be delivered by scientists of distinguished accomplishments, and are expected to arouse in their hearers a lasting interest in physical science.

### **MEETINGS**

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

### **EXHIBITIONS**

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.





# **HISTORICAL EXTRACTS**

**(CHRONOLOGICALLY STATED)**

About a century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Professor Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania, and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Professor Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Professor Keating set about to carry it into execution.

Four of the committee selected from 1200 to 1600 names of citizens from the City Directory and invited them to attend another meeting to be held at the county court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the county court house, Sixth and Chestnut Streets, for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry, delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

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blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock the corner-stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Monroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Mifflin, A. G. Ralston.



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**Building Committee of the Hall:**

Peter A. Browne, S. R. Wood, S. V. Merrick, James McAlpin, J. B. Garrigues.

Architect, Jno. Haviland.

M. Carpenter, Jas. Clarke.

M. Marble Mason, John Struthers.

M. Bricklayer, Daniel Groves.

The assembly was then addressed by P. A. Browne, Esq., and Adjourned.

(From the minutes of The Franklin Institute, Vol. A.)

Dr. Thomas P. Jones appointed Professor of Mechanics and Natural Philosophy.

October 6, 7 and 8, second exhibition of American manufactures held in Masonic Hall, Chestnut Street, west of Seventh. The number of articles exhibited far exceeded that of the previous year. Eighty-five premiums were offered. Six hundred and ninety-nine articles are listed in the catalogue of exhibits.

1826, January. First number of THE FRANKLIN JOURNAL was issued under the editorial management of Dr. Thomas P. Jones. In addition to his position as Editor, Doctor Jones also acted as Recording Secretary of the Institute and Curator of its collections. April 12, 1828, he was appointed Superintendent of the U. S. Patent Office.

The Institute extended its educational efforts by establishing on April 6 a High School in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October, 300 were studying English, 153 French, 105 Latin, 35 Greek, 45 Spanish, 20 German, 300 Elocution, 240 Geography, 231 Drawing, and all of them Mathematics. The School was continued until 1832 and was the predecessor of the Central High School.

October 3, 4, 5, 6, third exhibition of American manufactures was held in Masonic Hall. Silver medals were awarded for soft iron castings, flint glass ware, china from American materials, skirting and japanned leather, white lead, etc. Thirty-four thousand visitors.

1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the JOURNAL

of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steamboats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Prof. Walter R. Johnson, Matthias W. Baldwin, Frederick Graff and Isaiah Lukens. While the work of the committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the committee with its extensive report appeared in the issues of the JOURNAL of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May, 1836, and the results of the investigations on the strength of materials with numerous illustrations and detailed descriptions of original apparatus appeared in the JOURNAL February to August, 1837.

1831, October 4 to 8 inclusive, seventh exhibition of domestic manufactures held in Masonic Hall. Visitors exceeded forty thousand. Eighty-nine premiums were proposed of which fifteen were adjudged due. Fifteen additional premiums were recommended. A silver medal and one hundred dollars were awarded for a cast iron cooking stove for anthracite coal. Five hundred and forty-two articles were exhibited.

1832. Commenced an investigation into the resources of the Commonwealth considered in relation to its industry and manufactures, an occasion which led to a geological survey of the State.

Walter R. Johnson presented a notable communication on "The Strength of Cylindrical Steam Boilers." The results given are based on the extensive series of experiments made by the Institute's Committee on the Explosion of Steam Boilers.

1833. The Institute was requested by the State Legislature to examine and report upon a bill relating to weights and measures and admeasurement reported to the House of Representatives June 26, 1833. A special committee

of seventeen was appointed to consider the matter. The extensive report which included a detailed statement on the weights and measures of France, England and the United States, as well as an authentication of the Troy pound used in the United States Mint, appeared in the *JOURNAL* for November, 1833, and February to July inclusive, 1834. The Governor requested the committee to superintend the construction of the standards.

The present laws of the State are based on the recommendations made as a result of this investigation.

October 1 to 5 inclusive, eighth exhibition of domestic manufactures held in Masonic Hall. Over seven hundred exhibits. Fifty thousand visitors. Silver medals were awarded for lamps, pianos, rifles, hardware, carpets, cotton and woolen goods, etc.

1834. Joint committee of The Franklin Institute and the American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests. A circular issued by the committee requested observers to note the direction of the wind; to collect all information concerning storms—their width, direction, velocity, etc.; and the beginning and end of all rains. Detailed instructions were given for taking the “dew point.” The committee consisted of eight members, three from the American Philosophical Society and five from The Franklin Institute, Dr. James P. Espy acting as Chairman. This committee continued its work successfully until 1838, when that portion appointed by the Philosophical Society were discharged by that body and the Board of Managers at once appointed a standing Committee on Meteorology to continue the collection of the data. By an Act of the Legislature, passed March 31, 1837, two thousand dollars were appropriated with the further sum of one thousand dollars for each of the two years next ensuing, for the purpose of promoting the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, gingham, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical



1847, October 19 to 30 inclusive, seventeenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for blankets, shawls, woolen and worsted yarn, bars of iron, the chandelier made for the Opera House at New York, machinery, glass ware, book binders' dies, chemicals, etc. Seventeen hundred and forty-two exhibits.

1848, October 17 to 28 inclusive, eighteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for cotton and woolen goods, carpets, specimens of iron, lamps and gas fixtures, hardware, glass ware, furs, chemicals, etc. A first premium was awarded for a copy of the Webster dictionary, designed as a present to the Queen of England. Seventeen hundred and fifty-one exhibits.

1849, October 16 to 27 inclusive, nineteenth exhibition of American manufactures, held in the Philadelphia Museum Building. Silver medals were again awarded for products made from cotton and woolen materials, hardware and cutlery, also for Daguerreotypes, Talbottypes and Hyalotypes, boots and shoes, chemicals, needlework, etc.

1850. The School of Design for Women was founded by the Institute. Mrs. Sarah Worthington Peter, first Directress. Classes in art and design for women had been conducted by Mrs. Peter in her home, 327 South Third Street, for six years prior to the establishment of the school by the Institute.

In 1851 a room was leased at 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock



for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of arts and manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject. A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this committee resulted in the passage, by Congress, on March 3, 1871, of an Act to Provide for celebrating the 100th Anniversary of American Independence by holding an International Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1871. The committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August, 1871. The concluding report was published in August, 1872, and was fully discussed at the Stated Meeting of the Institute held in October, 1872 (*J. F. I.*, December, 1872, Vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873, and appear in the *JOURNAL* for December, 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Prof. J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (*J. F. I.*, Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Prof. Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874, the Legislature passed a bill providing for a state survey, which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the committee.

At the Stated Meeting of the Institute held March 19, 1873, it was resolved to recommend and petition the Legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and

determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufacturers held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one; paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded.

1875. An ordinance passed by Councils June 5 requested the Mayor to appoint a commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the JOURNAL for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum, London, and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1882. A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the JOURNAL for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the city as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a



Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the city and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without federal or state aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. Two hundred and sixteen exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American manufactures. Three hundred and seventy-five exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

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The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the coöperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the president of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897, and January and February, 1898.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States, presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS, It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

*Resolved*, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

*Resolved*, That the National Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the JOURNAL for June, July and August, 1902.

In order to promote both domestic and foreign commerce, the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18:

WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

*Resolved*, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

WHEREAS, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

WHEREAS, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

*Resolved*, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute, held September 19, at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

WHEREAS, It is the present established policy of the general Government to provide ample facilities for the water-borne commerce of the United States and to emancipate interstate commerce from the obstructions imposed by tolls or restricted canals under private or corporate control, and

WHEREAS, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have



invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

*Resolved*, That a committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the coöperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition. Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army.

Established School of Navigation for the United States Shipping Board.

Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air," by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life member of the Institute, for research. "Bartol Research Foundation," established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D.Sc., F.R.S., Fellow of Trinity College, Cambridge, England, delivered a course of lectures on "Atomic Weights and Isotopes."

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924, September 17, 18, 19. The centennial anniversary of the founding of The Franklin Institute in 1824 was celebrated by noteworthy exercises extending over three days, and at the same time exercises inaugurating the activities of the Bartol Research Foundation were held. These exercises consisted of formal conferences of a scientific nature, lectures by distinguished scientists, receptions, and the formal opening of the Bartol Research Laboratories, and were terminated by a great dinner given to the delegates and members of the Institute.

The delegates were received formally on the first day of the celebration. Lectures by forty-six world-renowned scientists and inventors were delivered during the three days. The hospitable citizens of Philadelphia entertained the delegates and visitors by luncheons, dinners, and lawn fêtes. Appropriate exercises were held at the Bartol Laboratories to signalize the completion of the preparations for active work under the Foundation.

The final centenary dinner brought together what was probably the most distinguished gathering of scientists from all the world ever collected in America. Greetings and congratulations, both formal and informal, were presented from all the institutions and societies represented. Speeches were made by at least one representative of every foreign country from which a delegate was present, and by representatives of the University of Pennsylvania and Princeton University. All expressed congratulations to the Institute for its honorable history and its long record of usefulness and all uttered confident good wishes for continued growth and success.

The lectures delivered during the Centenary Celebration were subsequently published by the Institute in the form of monographs.

1925, October 1. The first Bartol Research Foundation Fellow was appointed and active research work at the Laboratories was inaugurated.

1926, January 1. New cover design for JOURNAL adopted.

May 12. First celebration of Medal Day. All medals awarded during the year presented on this day.

December 26, 27, 29, 30. Inauguration of Christmas Week Lectures by Prof. R. W. Wood, Johns Hopkins University. Lectures on "Recreations with Radiations." Three monetary prizes awarded for best lecture note-books.

1927, January 12. Establishment of the James Mapes Dodge Lecture Foundation.



## **SPECIAL MEMORIAL LIBRARY FUNDS**

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**Bloomfield H. Moore Memorial Fund.** Established by Mrs. Clara Jessup Moore as a memorial to her husband. For the purchase and care of books.

**Memorial Library Fund of the International Electrical Exhibition of 1884.** For the purchase of books of reference on subjects relating to electricity.

**James T. Morris Memorial Fund.** Established by his brother John T. Morris. For the purchase of books on mechanics.

**M. Carey Lea Fund.** Bequest of Matthew Carey Lea. For the purchase of books on physics and chemistry.

**Harry W. Jayne Fund.** For the purchase of books on chemistry.

**Howard N. Potts Library Fund.** Bequest of Howard N. Potts. For the purchase of books.

**Louis Edward Levy Fund.** Founded by his family. For the purchase of books on the reproductive arts.

**Ware Library Fund.** Bequest of Lewis S. Ware. For the purchase and care of all publications on sugar.

**Isaac B. Thorn Memorial Fund.** Founded by his daughter, Miss Mary Thorn. Previously given as a scholarship fund and now permitted to be used for the purchase and care of books.

# **CHARTER AND BY-LAWS**

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## **THE FRANKLIN INSTITUTE**

### **OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS**

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the said

officers shall be elected at an annual meeting of the said corporation, to be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF  
PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is



## OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.***BY-LAWS OF THE INSTITUTE****ARTICLE I.—Stock**

**SECTION 1.** The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, *viz.*:—

*First Class.*—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers and managers upon the payment of One Dollar upon each share of stock on which they may desire to vote; provided, however, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

*Second Class.*—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

**SEC. 2.** The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefore, be entitled to a Certificate of Membership.

**SEC. 3.** If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

**SEC. 4.** Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; provided, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

**SEC. 5.** Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.



permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay the sum of One Hundred Dollars (\$100) in any one year.

SEC. 6. Resident members shall be residents of the City of Philadelphia who have been elected to membership in the Institute and who shall pay annual dues of Fifteen Dollars.

SEC. 7. Non-resident members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay annual dues of Five Dollars. They shall also pay an initiation fee of Five Dollars.

SEC. 8. Student members shall be over sixteen and under twenty-two years of age. They shall pay annual dues of Three Dollars if they do not receive the JOURNAL of the Institute, and Six Dollars if they do receive the JOURNAL. The term of student members shall be limited by the age of twenty-two years, after which time they shall be eligible for transfer to the other classes of membership upon the payment of the appropriate fee or dues.

SEC. 9. Privileges: All members, of whatever class, are entitled to participate in the meetings of the Institute, in the use of the Library, to receive tickets for the lectures, and to receive monthly one copy of the JOURNAL of the Institute, except that student members, and honorary and corresponding members shall not have the right to vote, nor to hold office, and student members paying the Three-dollar annual dues shall not receive the JOURNAL of the Institute.

### ARTICLE III.—*Payments of Dues*

SECTION 1. The annual fees for membership shall be due and payable on the first of October in each year, in advance, but all members elected after the thirty-first of March in each year shall pay in advance for the current year one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Controller. Should such dues not be paid when they become six months in arrears, the privileges of membership shall be suspended. When nine months in arrears such member shall be notified again, and if such dues become one year in arrears, the said member shall forfeit all connection with the Institute. The Board of Managers at its discretion may extend the time for payment and for the application of these penalties.

The Board of Managers may remit temporarily the annual dues of any member who, for reasons satisfactory to the Board, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. Resignations of membership shall be made to the Board of Managers in writing, but need not be accepted until all dues and arrears up to date of resignation shall have been paid.

SEC. 5. The annual dues from members may be applied to the current expenses of the Institute, but all moneys received from Life and Endowment

memberships shall be added to the capital account of the Institute, and only the income therefrom shall be applied to current expenses.

#### ARTICLE IV.—*Election of Officers*

SECTION 1. The officers shall be a President, three Vice-presidents, a Secretary, a Treasurer, a Controller, a Librarian, and twenty-four Managers.

SEC. 2. At the annual meeting of the Institute the President and the Treasurer shall be elected to serve one year, and one Vice-president, and eight Managers, shall be elected to serve for three years; provided, that the officers now elected or who may hereafter be elected shall continue to serve until their successors be elected.

SEC. 3. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy.

SEC. 4. Nominations for President, Vice-president, Treasurer and Managers shall be made in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 5. On the date of the annual meeting, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

#### ARTICLE V.—*Duties of Officers*

SECTION 1. The President shall be the executive head of the Institute and as such shall have the general direction and supervision of all the affairs of the Institute. He shall preside at all meetings of the Institute and of the Board of Managers and shall be *ex officio* a member of all committees of the Institute and of the Board.

SEC. 2. The Vice-presidents shall exercise the duties of the President in his absence in the order of their seniority in office.

SEC. 3. The Secretary of the Institute shall be appointed by the Board of Managers and shall have charge and supervision, subject to the Board of Managers, of all the scientific activities of the Institute, other than those connected with the Bartol Research Foundation, its publications, museum and equipment. He shall keep the minutes of all meetings of the Institute and



of the Board of Managers, and shall perform all the duties usually pertaining to the office of Secretary. He shall be *ex officio* a member of the Board of Managers, and of all standing committees of the Institute and of the Committee on Publications of the Board of Managers.

SEC. 4. The Treasurer shall receive all funds, payable to the Board of Managers, and all moneys collected for the Institute. He shall deposit all moneys received, in the name of the Institute, in such banks or trust companies as the Board of Managers may direct. He shall make no payments without the authority of the Board of Managers. He shall see that there are kept accurate accounts of the income and disbursements of the Institute, shall report current receipts and payments at each stated meeting of the Board of Managers, and shall make a detailed statement of the financial condition of the Institute at its annual meeting. He shall give bond to an amount, and with such surety, as the Board of Managers shall determine. In case of a vacancy in the office of Treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position until the next annual meeting.

SEC. 5. The Board of Managers shall appoint the Controller, who shall keep all the accounts of the Institute, shall collect all moneys due the Institute and deposit them in the Treasurer's account, and shall approve all expenditures. He shall act with the Committee on Finance in the preparation of the annual budget. He shall act as the business agent of the publications of the Institute. He shall have charge of the buildings of the Institute and shall be responsible for their maintenance, repairs and insurance. He shall perform such other duties as may be prescribed by the Board of Managers.

SEC. 6. The Board of Managers shall appoint a Librarian, who shall have charge of the library and reading-room of the Institute, and who shall perform the duties usually pertaining to such office, subject to instructions from the Board.

#### ARTICLE VI.—*Board of Managers*

SECTION 1. The Board of Managers shall have entire charge and control of the affairs of the Institute, and shall consist of twenty-four members elected as provided in Article IV. The President, the Vice-presidents, the Secretary, the Treasurer, and the Chairman of the Committee on Science and the Arts shall be *ex officio* members.

SEC. 2. They shall present, through the President, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 3. They shall hold stated meetings once in each month except in July and August. The chairman shall be the President of the Institute. Seven of their members shall constitute a quorum.

SEC. 4. Special meetings may be called by the President at his discretion, and shall be called by him on written request of the Executive Committee or of any seven members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Secretary.

SEC. 5. Members who have not attended five regular meetings in the twelve months prior to the stated meeting of the Institute in December, shall be

reported thereat as having resigned, unless it be unanimously voted by the Board at that meeting, that such member has been absent for sufficient reason.

SEC. 6. All vacancies on the Board of Managers shall be filled by the Board until the next annual meeting of the Institute.

#### ARTICLE VII.—*Committees of the Board of Managers*

The following standing committees of the Board of Managers, each consisting of five members, shall be appointed by the President and approved by the Board:

1. Executive. 2. On Endowment. 3. On Finance. 4. On Membership.
5. On Publications. 6. On Bartol Research Foundation.

The Executive Committee shall make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

The Committee on Finance shall have charge of all securities and investment funds belonging to the Institute and shall invest and reinvest the same and pay the income therefrom to the Treasurer of the Institute. The Committee may, with the approval of the Board of Managers, appoint a trust company of the City of Philadelphia to act as fiscal agent under the direction of the Committee. All purchases or sales of securities shall be reported monthly to the Board.

The Bartol Research Foundation Committee shall have charge of the provision, maintenance and operation of all laboratories and equipment concerning the Bartol Research Foundation. It shall engage the professional staff subject to the approval of the Board of Managers of the Institute and shall also engage and direct the operators and helpers employed in the work of the Foundation. It shall be composed of not more than twelve members, as follows: Five members of the Board of Managers, appointed by the President and approved by the Board; the President; the Director of the Bartol Research Laboratories; five members appointed by the President with the approval of the Board from the membership of the Institute not members of the Board.

The Director of the Bartol Research Laboratories shall report to the Bartol Research Foundation Committee. All other employees of the Foundation shall report to the Director. The Committee shall have full power to carry out the purposes of the Foundation. It shall make a report of its operation to the Board of Managers at each stated meeting.

#### ARTICLE VIII.—*Audits*

The accounts of the Treasurer and of the Fiscal Agent shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

#### ARTICLE IX.—*Committees of the Institute*

SECTION 1. There shall be the following standing committees of the Institute:

1. On Library.
2. On Meetings.
3. On Museum.
4. On Science and the Arts.

SEC. 2. The Committees on Library, Meetings and Museum shall consist of ten members each, appointed by the President at the first stated meeting after the annual election, to serve one year.

SEC. 3. The Committee on Library shall purchase books and other publications of a kind and character suitable to and consonant with the purpose of the Institute's library.

SEC. 4. The Committee on Meetings shall act with the Secretary of the Institute to secure for presentation before the Institute papers dealing authoritatively with subjects of import in the fields of physical science and engineering.

SEC. 5. The Committee on Science and the Arts shall consist of sixty members who shall serve three years. Twenty shall be elected each year by the Board of Managers at the first meeting after the annual election. The Committee shall investigate current discoveries, inventions and other achievements of workers in the physical sciences and their application in the mechanic and industrial arts with a view of affording such recognitions as lie within the power of the Institute to bestow.

SEC. 6. These committees shall organize and adopt rules and regulations suitable to their several activities, subject to the approval of the Board.

#### ARTICLE X.—*Meetings*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

#### ARTICLE XI.—*Amendments*

These By-Laws may be altered or amended at any stated meeting of the members of the Institute, provided notice in writing, signed by two members, of the proposed alteration or amendment, shall be given to the Board of Managers two months prior to the said meeting, except that amendments to Article I, relating to capital stock, must be ratified subsequently by a majority of the stock represented at a meeting specially called for this purpose.

### BY-LAWS OF THE BOARD OF MANAGERS

#### *Organization Meeting.*

A meeting for the purpose of organizing, electing members of the Committee on Science and the Arts, appointing a Secretary, an Assistant Secretary and Librarian, a Controller and Standing Committees, shall be held on the fourth Wednesday in January, at 4.15 o'clock, P.M.

#### *Stated Meetings.*

Stated meetings shall be held on the second Wednesday of each month at 12.30 o'clock, P.M.

#### *Order of Business.*

1. Calling the roll.
2. Reading the minutes of the previous meeting.
3. Report from Treasurer.

4. Reports from Standing Committees of the Board of Managers:
  - (a) Finance.
  - (b) Membership.
  - (c) Publications.
  - (d) Bartol Research Foundation.
  - (e) Endowment.
  - (f) Executive.
5. Reports from Standing Committees of the Institute:
  - (a) Library.
  - (b) Meetings.
  - (c) Museum.
  - (d) Science and the Arts.
6. Reports from Special Committees.
7. Deferred Business.
8. New Business.

*Reports.*

All committees of the Board shall keep regular minutes of their proceedings and shall report monthly to the Board; they shall also report, through the Committee on Finance, to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

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## AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

- The Franklin Medal.**
- The Elliott Cresson Medal.**
- The Howard N. Potts Medal.**
- The Louis Edward Levy Medal.**
- The George R. Henderson Medal.**
- The Walton Clark Medal.**
- The John Price Wetherill Medal.**
- The Edward Longstreth Medal.**
- The Certificate of Merit.**
- The Boyden Premium.**

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Louis Edward Levy Medal, the George R. Henderson Medal, the Walton Clark Medal, the John Price Wetherill Medal, the Edward Longstreth Medal, or the Certificate of Merit.

**The Franklin Medal** (Gold Medal and Certificate).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

**The Elliott Cresson Medal** (Gold Medal and Certificate).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

**The Howard N. Potts Medal** (Gold Medal and Certificate).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles.

**The Louis E. Levy Medal** (Gold Medal and Certificate).—This medal is awarded to the author of a paper of especial merit, published in the JOURNAL OF THE FRANKLIN INSTITUTE, preference being given to one describing the author's experimental and theoretical researches in a subject of fundamental importance.

**The George R. Henderson Medal** (Gold Medal and Certificate).—This





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have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

**The Elliott Cresson Medal.**—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The Trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscription: The obverse—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

**The Howard N. Potts Medal.**—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate



have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

**The Elliott Cresson Medal.**—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

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for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

**The Louis E. Levy Medal.**—Under date of December 12, 1923, the following letter was received from Mr. Lionel F. Levy, a member of the Committee on Science and the Arts:

"To The Board of Managers of

"The Franklin Institute of The State of Pennsylvania,

"Philadelphia, Pennsylvania.

"Gentlemen:

"Understanding from my associates on your Committee on Science and the Arts that a feeling obtains among them that the purposes of the Institute would be aided should there be available to the Institute a medal for the recognition of contributions to the JOURNAL, I take the liberty of addressing you to say that my brother, Mr. Howard S. Levy, my sister, Miss Hortense Levy, and I will be glad to found a medal in memory of our Father, the late Louis E. Levy, under the following general conditions:

"First: That we furnish a sum not exceeding five hundred (\$500) dollars to cover the cost of an appropriate design and the necessary dies and diplomas.

"Second: That the medal be of gold and have an intrinsic value of about sixty (\$60) dollars.

"Third: That we furnish the sum of two thousand (\$2000) dollars to be known as the Louis E. Levy Medal Fund.

"Fourth: That the interest on this fund shall be used from time to time in awarding the Louis E. Levy Medal for papers contributed to the JOURNAL of the Institute, descriptive of the author's researches in physical science or of his engineering achievements, which have added largely to the sum of knowledge or aided greatly the well-being of mankind.

"Fifth: That any excess of income from this fund beyond that necessary for the number of medals which the Institute may think best to award shall be added to the Louis E. Levy Library Fund.

"I am,

"Very truly yours,

"(Signed) LIONEL F. LEVY."

This matter was brought to the attention of the Board of Managers at their meeting on December 12, 1923, and the proposed fund was accepted.

**The George R. Henderson Medal.**—Under date of September 24, 1924, the following communication was presented to the Acting Secretary:

"I herewith present to The Franklin Institute the sum of two thousand five hundred dollars (\$2500). Of this amount a sufficient sum is to be used for the cost of preparing dies for a medal to be known as the George R. Henderson Gold Medal which is to be awarded by the Institute on the recommendation of the Committee on Science and the Arts for meritorious inventions or discoveries in the field of railway engineering. The remaining amount is to constitute a fund in trust, the net income from which, or such portion thereof as may be needed, shall be used for the purchase of the said gold medal as required.



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"Any accumulation after providing the medals shall, after each period of five years, be added to the trust fund, and if this fund increases to double the original amount, one-half the net income may be used to provide the Henderson Medal for inventions in other fields than railway engineering.

"(Signed) VIRGINIA P. C. HENDERSON."

This was presented to the Board of Managers for consideration at their meeting on October 8, 1924, and was duly accepted.

**The Walton Clark Medal.**—On November 30, 1926, the United Gas Improvement Company of Philadelphia presented to The Franklin Institute a sufficient fund to permit of the award, not more frequently than once a year, of a gold medal, to be known as the Walton Clark Medal, "to the author of the most notable advance in knowledge, or improvement in apparatus, or in method, concerning the science or the art of Gas Manufacture, or distribution or utilization in the production of illumination or of heat, or of power." The obverse of the medal bears a profile relief of Dr. Walton Clark, and is inscribed around the margin, "The Walton Clark Medal." The reverse bears the legend "Awarded by The Franklin Institute to \_\_\_\_\_ for original and notable work in the gas industry."

The donors of the Medal generously agreed to the following condition: "If, in the opinion of the Institute, in any year there is no basis for award, it will be agreeable that the income shall be used for the acquisition of books covering the subjects of manufacturing gas, to be placed in an alcove, or other suitable place, properly marked with reference to Mr. Clark."

**The John Price Wetherill Medal.**—On April 3, 1917, the family of the late John Price Wetherill gave to The Franklin Institute a certain sum as the first contribution toward the establishment of a Fund for the promotion of research, to be known as "The John Price Wetherill Memorial Research Fund."

On June 10, 1925, the Board of Managers of The Franklin Institute, in accordance with the desires of the family of Mr. Wetherill, voted to set aside as much of this Fund as might be necessary, for the design and production of a silver medal, to be known as "The John Price Wetherill Medal," and to be awarded for discovery or invention in Physical Sciences, or for new and important combinations of principles or methods already known.

The obverse of the medal bears a profile relief of Mr. Wetherill and is inscribed around the margin—"The John Price Wetherill Medal 1925."

The reverse bears the legend: "Awarded by The Franklin Institute to \_\_\_\_\_ for discovery, invention, or development in the physical sciences."

**The Edward Longstreth Medal.**—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

*“Resolved, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.*

*“Resolved, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose.”*

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, “The Edward Longstreth Medal of Merit, Founded 1890.” On the reverse is inscribed around the margin, “Awarded by The Franklin Institute,” and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

**The Certificate of Merit.**—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

*“Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:*

*“‘The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to \_\_\_\_\_ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.*

*“‘Report No. \_\_\_\_\_ Approved, \_\_\_\_\_19 \_\_\_\_\_*

*“‘\_\_\_\_\_President.*

*“‘[SEAL]*

*\_\_\_\_\_Secretary.*

*“‘Chairman of the Committee on Science and the Arts.’”*

**The Boyden Premium.**—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

“Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of  $2 \times 10^{14}$  double vibrations per second in the infra-red and  $8 \times 10^{14}$  in the ultra-violet, travel through free space with the same velocity.”

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

# REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

## ARTICLE I.—*Investigations*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. A request or a recommendation for the investigation of a subject shall be made in writing addressed to the Secretary who will submit it with full detailed information to the Sub-committee on New Subjects and Preliminary Examination. If this Sub-committee recommends it as a suitable subject for investigation to the Committee on Science and the Arts, and if this recommendation is adopted by the General Committee, the Secretary shall notify the applicant accordingly and furnish an application blank substantially like the form appended.

SEC. 4. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for investigation unless the subject for investigation be referred to the Committee by a vote of the Institute.

## ARTICLE II.—*Meetings of the Committee*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July, August and September.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meetings the Committee shall proceed in the following

### *Order of Business:*

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Approval of bills.
4. Reading of correspondence.
5. Report of sub-committee on new subjects and preliminary examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.



8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

#### ARTICLE III.—*Chairman*

SECTION 1. A Special Committee for nominating a Chairman for the ensuing year, consisting of three recent past Chairmen, shall be appointed at the January Meeting of the Committee, this special committee to report its nomination of a candidate at the February meeting. At this meeting, additional nominations may be made by any member of the Committee on Science and the Arts. The election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees of investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

#### ARTICLE IV.—*Standing Sub-committees*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-committee on New Subjects and Preliminary Examination." The duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to coöperate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each February by the Chairman, from the membership, a sub-committee styled the "Sub-committee on Literature," consisting of six members. It shall be the duty of this sub-committee to examine carefully all papers that are published in the Institute's JOURNAL during

the current calendar year, and to report to the Committee not later than January of the following year, which, if any, of those papers deserve the award of the Louis Edward Levy Medal.

SEC. 3. There shall be appointed by the Chairman from the membership each February, a sub-committee styled the "Sub-committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-committees on Investigation of Applications*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to all members thereof giving the names of the members of the sub-committee.

SEC. 4. No person who is interested in the issue shall be a member of the sub-committee on investigation.

SEC. 5. An applicant for investigation may withdraw his application at any time before final action by the Committee; which withdrawal shall be reported to the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

#### ARTICLE VI.—*Sub-committee Meetings*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

#### ARTICLE VII.—*Sub-committees' Reports*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B hereto appended.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the George R. Henderson Medal, the Walton Clark Medal, the Howard N. Potts Medal, the John Price Wetherill Medal, the Edward Longstreth Medal or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendations may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the Chairman of the sub-committee, but without changing its meaning or effect.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

\_\_\_\_\_  
*Secretary.*

SEC. 9. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of its descriptive portion may be furnished the applicant, who may make an explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 10. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of at the time of the first reading.

SEC. 11. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

#### ARTICLE VIII.—*Reconsideration*

SECTION 1. Upon the adoption of a report of a sub-committee, a motion for reconsideration must be made within the next three months. If such a motion is made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

#### ARTICLE IX.—*Advertisement of Recommendations*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the George R. Henderson Medal or the John Price Wetherill Medal, publication shall be made in three successive issues of the JOURNAL OF THE FRANKLIN INSTITUTE, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within the time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement or manufacture.

SEC. 2. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal, the Louis Edward Levy Medal, the Walton Clark Medal, the Edward Longstreth Medal or the Certificate of Merit, shall be conclusive without advertisement.

#### ARTICLE X.—*Protests*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next

stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

#### ARTICLE XI.—*Institute Reports*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C appended. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. On the completion of an investigation, the applicant shall be provided with a certified copy of the Institute's report.

#### ARTICLE XII.—*Amendments to Regulations*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

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Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition. It is suggested that future awards be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions and physical processes.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the John Price Wetherill Medal be awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

4. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science.

5. That the George R. Henderson Medal be awarded in recognition of meritorious inventions or discoveries in the field of railway engineering.

6. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

7. That the Louis Edward Levy Medal be awarded in recognition of papers contributed to the JOURNAL of the Institute, which are of superior excellence and descriptive of a field in science or engineering to which the author has contributed fruitful research.

8. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

**REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS**

**FORM A**

**(Application for Investigation)**

**THE FRANKLIN INSTITUTE**

**OF THE**

**STATE OF PENNSYLVANIA**

**FOR THE**

**PROMOTION OF THE MECHANIC ARTS**

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled .....  
..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

**IMPORTANT TO APPLICANT**

This application carefully filled in and other available matters descriptive of the invention or process, together with two copies of each of the United States patents issued to applicant, must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

YEAR BOOK OF  
FORM B  
(Sub-committee Report Form)  
THE FRANKLIN INSTITUTE  
OF THE  
STATE OF PENNSYLVANIA  
FOR THE  
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No. ....

REPORT OF SUB-COMMITTEE, dated .....

Investigating .....

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject reports  
as follows:

.....

In consideration of the { discovery  
excellence of construction  
ingenuity and novelty  
or

of .....your sub-committee recommends

the award of ..... to ..... of .....

Respectfully submitted,

..... Chairman.

.....

.....

.....

Adopted at the Stated Meeting of ..... 19 .....

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,.....

S. & A. Case No. ....

The Franklin Institute of the State of Pennsylvania, acting through its  
Committee on Science and the Arts, investigating .....

..... reports as follows:

.....

In consideration of the {  
discovery  
excellence of construction  
ingenuity and novelty  
or

of ..... the Institute awards the.....

.....

to ..... of .....

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned .....

*Chairman of the Committee on Science and the Arts.*



# **PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS**

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## **REPORT OF THE PRESIDENT**

**FOR THE YEAR ENDED DECEMBER 31, 1926**

*To the Members of The Franklin Institute:*

The end of the year brings to the President an opportunity to review, in his annual report, the activities of The Institute, and to record his appreciation of the work which has been so well carried on by the various Committees.

### **COMMITTEE ON MUSEUM**

The Committee on Museum, Mr. Hugo Bilgram, Chairman, reports that the following additions have been made to the Institute's historical collections:

A clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S.W. 1, England.

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Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J.

"The Declaration of Independence," painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia.

The Institute highly values these accessions, and records its thanks to the donors. It is timely to repeat and emphasize the statements in previous Annual Reports, that the present lack of space and facilities prevents the proper display and protection of the many notable exhibits in the Institute's historical collections. This condition will exist until a thoroughly equipped museum is provided. Active efforts are now being made to secure a suitable site on the Parkway, so that a museum worthy of the Institute's great traditions may be erected.



In making up the programme for the year the Committee on Meetings attempted to procure a paper of general scientific interest to be read at the monthly meetings, while the papers of more restricted or more technical character were presented at the regular weekly meetings. This arrangement seems to have worked well.

#### COMMITTEE ON LIBRARY

The Committee on Library, Mr. W. H. Fulweiler, Chairman, reports that there have been purchased, donated and obtained by increased binding, a total of 4586 accessions to the Library. These consist of 1012 bound volumes, 213 unbound volumes, 3349 pamphlets, 1 map, 9 drawings and 2 lithographs. The Institute is glad to record its thanks to Mr. Henry Howson, Mr. Wm. R. Webster, Philadelphia Book Company, Mr. Theodore J. Lewis, Shoemaker Bridge Company, Mr. Clarence A. Hall and the Philadelphia Office of the McGraw-Hill Publishing Company, Inc., for gifts of books, pamphlets and magazines. The Institute is again under obligation to the many scientific and technical societies throughout the world, the various government departments, state and municipal officials and the many industrial establishments who have from time to time supplied the library with publications on technical subjects. Statistics submitted by the Committee showing that the Library contains 85,152 bound and unbound volumes, 25,529 pamphlets, 2299 maps and charts, 1356 photographs and 795 drawings, designs, lithographs, etc., indicate the rich store of scientific and literary material which is available in the Library. The Committee again strongly urges that very serious consideration be given to providing increased space and equipment for the Library.

#### COMMITTEE ON SCIENCE AND THE ARTS

The Committee on Science and the Arts, Mr. Clarence A. Hall, Chairman, reports that investigation and final disposition were made of seventeen cases, and eleven new cases are now pending. Sixteen awards were made as a result of these investigations. The Sub-committee on New Subjects and Preliminary Examination held nine stated meetings during the year at which forty-six subjects were considered. Twelve of these were recommended for investigation and applications were received from eight of them. Four special cases were also recommended for investigation for which no application was required. These recommendations were accepted by the General Committee and Sub-committees of investigation were appointed. The standing Sub-committees on Literature and The Franklin Medal held their customary meetings, and recommended the award of this Medal and the other medals which were presented at the May meeting.

An outstanding event of the year was the presentation to the Institute by the United Gas Improvement Company, of a fund for the establishment of the Walton Clark Gold Medal. In presenting this fund the donors state:

"The income from this investment to be used to provide a medal to be awarded by the Institute, not more frequently than once a year, to the author of the most notable advance in knowledge or improvement in apparatus, or in method concerning the science or the art of gas manufacture or distribution or utilization in the production of illumination, or of heat, or of power."

The first award of this Medal was made to Doctor Walton Clark on the afternoon of Tuesday, December 21st. The award was made on the recommendation of the Committee on Science and the Arts in consideration of Doctor Clark's life work in the American gas industry and his distinguished and outstanding contributions to the technical progress in that industry.

Valuable service was rendered by a number of the members of the Committee in acting as members of the various juries of award at the Sesqui-Centennial International Exposition. Officials of the Exposition have expressed their appreciation of the service rendered. The character of this service may be judged by the fact that Mr. James S. Rogers was made Chairman and Mr. Harold Calvert, Secretary, of the Group Jury, before which cases came for final decision.

In the death, on February 22, 1926, of Mr. William H. Thorne, the Committee on Science and the Arts lost a member who had rendered a valued service for many years. His term of membership was unusually long, preparations having been made to recognize the fiftieth anniversary of his becoming a member, at the next meeting of the Committee after his death.

Two new members, Mr. N. W. Akimoff and Mr. William L. Brown, 3d, were elected to fill vacancies on the Committee.

#### COMMITTEE ON MEMBERSHIP

The Committee on Membership, Mr. R. W. Lesley, Chairman, reports that 140 new members were elected up to December 31, 1926. Resignations, members dropped for non-payment of dues, and the death of 37 members, bring the net increase in membership to 60. There are at present, in all classes of membership, 1470 members.

Nothing in the nature of a campaign for membership is being conducted, but a few members of the Board of Managers of the Institute have by personal effort obtained a considerable number of new members.

#### COMMITTEE ON FINANCE

The Committee on Finance, Mr. Walton Forstall, Chairman, reports the total expenses of the Institute during the fiscal year ended September 30, 1926, were \$65,205.67, and the total income \$53,877.54. Though this shows an operating deficit of \$11,328.13, there was, during the year, a net increase of assets over liabilities—amounting to \$7689.84; therefore, the figures show a definite gain.

The principal and accumulated income of the Bartol Research Foundation Fund now amount to \$1,666,585.96. The expenses of the Bartol Research Foundation were \$41,849.93 and the income \$90,022.49, showing a surplus of \$48,172.56.

#### BARTOL RESEARCH FOUNDATION

The work of the Bartol Research Foundation has been going ahead in a very satisfactory way under the able advisory direction of Dr. W. F. G. Swann, of the Sloane Laboratory, Yale University, and Professor E. P. Adams, of Princeton University. A number of important investigations of an unusual character have been made, the results of which are appearing in papers contrib-

uted from time to time to the JOURNAL of the Institute; also a series of afternoon lectures has been presented at the Institute and is being published in the JOURNAL. A number of additional Fellows have been appointed.

#### CHRISTMAS WEEK LECTURES FOR YOUNG PEOPLE

One of the innovations of the Institute's work during the past year was a series of four popular lectures with experiments for young people given during Christmas Week. These lectures were on the subject of "Recreations with Radiations" and were delivered by Professor R. W. Wood, head of the Department of Physics of Johns Hopkins University. A nominal charge of five dollars was made for this series of lectures. The Institute awarded prizes for the best note book records made by students who attended these lectures. For nearly a century, similar lectures have been given with preëminent success before the Royal Institution of London by such brilliant scientists as Faraday, Tyndall, Bragg, and others. Those lectures are so popular that there is a waiting list for the tickets; a gift of a ticket for the series is considered a most acceptable Christmas offering.

The success and continuance of these lectures from year to year are assured through a gift from Mrs. James Mapes Dodge to establish "The James Mapes Dodge Lecture Foundation" in memory of her husband, who was a very active member of the Institute, a member of the Board of Managers, and a Vice-President. This gift is Five Thousand Dollars in cash and in addition an annual payment to the Institute, during her lifetime, of Two Hundred and Fifty Dollars. I am glad to record the Institute's great appreciation to Mrs. Dodge for this generous gift.

#### AUDIT

Lybrand, Ross Bros. and Montgomery, certified public accountants, audited the accounts for the fiscal year ended September 30, 1926, and reported them to be correct.

All of the work of the Institute has been carried on most capably during the past year under the direction of Dr. Howard McClenahan, the Secretary; and the staffs of both the Institute and the Bartol Research Foundation have, by their continued faithful service and interest, maintained the high standards of the Institute. It is a pleasure to express to them and to all of the Committees my great appreciation of their efforts.

Respectfully submitted,

WM. C. L. EGLIN,  
*President.*

Note—May 20, 1927.—We are glad to announce that Doctor Swann has accepted the invitation to become the first Director of the Bartol Research Foundation Laboratories. He will assume this office on September 1, 1927. It is a matter of first importance to the Institute that the Bartol Research Foundation Laboratories are to be under Dr. W. F. G. Swann as Director. He is the head of the Department of Physics, Yale University, and is one of the leading physicists and research men of the United States. In him the Bartol Laboratories will have a distinguished and enthusiastic leader.

## REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the President and Members of the Franklin Institute:*

The Committee on Library respectfully submits the following statement of activities in the Library during the year ending September 30, 1926.

The additions to the Library were as follows:

Source.	Bound Volumes.	Unbound Volumes.	Pamphlets.	Maps.	Draw- ings.	Litho- graphs.
By Gift .....	230	178	3346	1	9	2
Binding .....	616					
Purchase						
Books and Periodicals	5	4				
Jayne Fund .....	4	1				
Journal .....	33	6	1			
Lea Fund .....	16	9	1			
Levy Fund .....	13	1				
Memorial Lib'y Fund	3					
Moore Fund .....	36	3				
Morris Fund .....	21	1				
Potts Fund .....	10					
Ware Fund .....	25	10	1			
	<u>1012</u>	<u>213</u>	<u>3349</u>	<u>1</u>	<u>9</u>	<u>2</u>
Total additions .....						4586

The Committee had at its disposal \$3994.70 appropriated by the Board of Managers and \$2962.29 income of the various trust funds.

The expenditures for the year were \$1405.12 for binding; \$4660.22 for books and subscriptions to magazines and other periodical publications, and \$612.38 for general expenses.

Gifts of books, pamphlets and magazines were received from Mr. Henry Howson, Mr. Wm. R. Webster, Philadelphia Book Company, Mr. Theodore J. Lewis, Shoemaker Bridge Company, Mr. Clarence A. Hall, and the Philadelphia Office of the McGraw-Hill Publishing Company, Inc.

The Institute is again under obligations to the many scientific and technical societies throughout the world, the various government departments, state and municipal officials and to the many industrial establishments who have from time to time supplied the library with publications on technical subjects.

The contents of the Library on September 30, 1926, were:

Volumes, bound and unbound .....	85,152
Pamphlets .....	25,529
Maps and charts .....	2,299
Photographs .....	1,356
Drawings, Designs, Lithographs, etc. ....	795

*Binding:*

During the year the following work was done by the binders:

Recent volumes of periodicals .....	577
Volumes of magazines charged to Chemical Periodicals	
Binding Fund .....	39
Volumes charged to the Ware Fund .....	66
Old volumes bound .....	71
Old volumes rebound .....	34

*Magazines and other periodical publications:*

6387 copies of the JOURNAL were distributed for exchange purposes.

26 new exchanges were added to the mailing list and 23 were removed.

The total number of exchanges on September 30 was 525.

The subscriptions for the year totalled 214. These were distributed geographically as follows:

Domestic .....	112
German .....	60
English .....	19
French .....	12
Belgian .....	3
Czechoslovakian .....	2
Italian .....	2
Swiss .....	1
South African .....	1
Australian .....	1
Indian .....	1

The number of publications received by gift was 270, making the total periodical publications received by the Library during the year 1009.

It will be noted that there has been a considerable increase in the total additions to the Library last year but these have been mainly in the form of pamphlets.

While there have been added several steel stacks on the third floor, the Library is still in urgent need of additional stack space for the proper care and handling of our books. The Library Committee wishes again to call attention to the serious conditions under which they are laboring in connection with a very large number of unbound publications. Such material is almost unavailable, is very difficult to handle and requires considerably greater space for storage than the bound books. Furthermore, in connection with the patents, we are obligated by the terms under which we receive these patent specifications to keep them available for public use; in many cases, this is only theoretically possible.

We would strongly urge that the Finance Committee give serious consideration to this very serious problem to the end that we may make all of the material in the Library available and thus greatly increase its usefulness.\*

No changes have occurred in the Library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,  
*Chairman.*

PHILADELPHIA, January 12, 1927.

\*Since the above report was presented, the Board of Managers has made a grant of \$5000 for binding the U. S. Patent Specifications. This grant will bring the binding of this literature strictly up to date, and will make it fully available for convenient use.

The Librarian.

## REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

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Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,  
*Chairman.*

PHILADELPHIA, January 12, 1927.

## REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,



**REPORT OF THE COMMITTEE ON MUSEUM****FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

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Recent volumes of periodicals .....	577
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*Magazines and other periodical publications:*

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The total number of exchanges on September 30 was 525.

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Italian .....	2
Swiss .....	1
South African .....	1
Australian .....	1
Indian .....	1

The number of publications received by gift was 270, making the total periodical publications received by the Library during the year 1009.

It will be noted that there has been a considerable increase in the total additions to the Library last year but these have been mainly in the form of pamphlets.

While there have been added several steel stacks on the third floor, the Library is still in urgent need of additional stack space for the proper care and handling of our books. The Library Committee wishes again to call attention to the serious conditions under which they are laboring in connection with a very large number of unbound publications. Such material is almost unavailable, is very difficult to handle and requires considerably greater space for storage than the bound books. Furthermore, in connection with the patents, we are obligated by the terms under which we receive these patent specifications to keep them available for public use; in many cases, this is only theoretically possible.

We would strongly urge that the Finance Committee give serious consideration to this very serious problem to the end that we may make all of the material in the Library available and thus greatly increase its usefulness.\*

No changes have occurred in the Library staff during the past year.

Respectfully submitted,

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\*Since the above report was presented, the Board of Managers has made a grant of \$5000 for binding the U. S. Patent Specifications. This grant will bring the binding of this literature strictly up to date, and will make it fully available for convenient use.

The Librarian.

## REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia, March 4, 1926.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,  
*Chairman.*

PHILADELPHIA, January 12, 1927.

## REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,



upon the polarization of resonance radiations and pointed out how polarization of light could be destroyed by a magnetic field of the strength of the earth's field. He demonstrated the experimental arrangement which showed that the presence of nitrogen at low pressures in the vacuum may increase the luminosity greatly. He showed experimentally samples of resonance radiation and demonstrated the production of such radiation by ultra-violet light. He closed his lecture by an experimental display of a time lag of the luminosity of hydrogen excited by ultra-violet light behind the ultra-violet light producing the luminosity.

Thursday, January 7, 1926: John Lyle Harrington, C.E., Consulting Engineer, Kansas City, Missouri, past president of the American Society of Mechanical Engineers and advisory bridge engineer, spoke on "Movable Bridges." The lecturer stated that the construction of bridges dates back to the time of Julius Cæsar. There was little change of bridge construction until the need for the bridging of navigable streams caused the beginning of the development of present day bridges. The rights of navigation were dominant and demanded that bridges should be movable. Swing bridges were developed early because of the railroads. The first vertical lift bridge was built in Chicago thirty-five years ago. The bascule type of bridge developed simultaneously with the vertical lift bridge, and proved to be more economical because of height and clearance. The lecture was generously illustrated with photographs and drawings of the various types of bridges, and showed samples of bridges which had been in actual use for many years. The reading of the paper was followed by an animated discussion which continued for well nigh an hour.

Thursday, January 14, 1926: Stuart C. Dodd, Fellow in Applied Psychology, Princeton University, lectured on "Applications and Mechanical Calculation of Correlation Coefficients." The talk was divided into two portions: "Applications" and "Calculations." The lecturer first defined the term "correlation" and pointed out its significance. He cited many varieties of correlation, such as rectilinear and curvilinear, partial, multiple and reliability correlations, with the conditions of ranging and sampling. He illustrated by examples from insurance and employment offices, agricultural, educational, and other biometric fields of research. Under the heading of "Calculation" he enlarged upon the arithmetic of correlation and showed the significance of the means, standard deviations and correlation formulæ. He then demonstrated a mechanical calculator designed by him and used especially in the calculation of intelligence coefficients for candidates for college admission. With this machine Mr. Dodd can make five statistical calculations with one turn of the handle. At the end of the meeting the audience kept the lecturer occupied for a considerable time explaining and demonstrating his machine.

Wednesday, January 20, 1926: Dr. C. E. K. Mees, Director of the Research Laboratories of the Eastman Kodak Company, gave a brilliant talk on "The Color Sensitivity of Photographic Materials." He described at length the efforts which had been made by the Eastman Company to produce photographic plates in particular which are sensitive to the longer light waves. Step by step the development of infra-red sensitive plates was described and the results obtained thereby were shown photographically, as well as by description. Wave lengths of more than nine thousand light units could be photographically





the one or the other showed the advantage. The theory of the chemical actions involved was discussed and the influence of change of the nature of material, the physical character of the plate, and the use of insulating separators, were clearly shown. Finally, the particularly strong points of the two types of cells were displayed.

Wednesday, February 17, 1926: Major Theodore Lyman, Professor of Physics and Director of the Jefferson Physical Laboratory of Harvard University spoke on "Radiations." He discussed at the outset, in a cursory way, radiations in general from the longest known ones to the extremely short X-rays. A diagram of all such radiations was drawn on a logarithmic scale. He pointed out the exceedingly small portion of this diagram which was covered by visible light rays. Major Lyman spoke especially of the region of Schumann's rays and especially of that region out to 200 Angstrom units, which rays are known as "Lyman rays." Beyond the Lyman rays is a sort of "no man's land" which has not yet been traversed. Beyond that region come the X-rays which are being successfully attacked by diffraction and the study of crystal lattices. Major Lyman described the work of Schumann and then the improvements in apparatus and in technic which had been introduced by himself. By these improvements he had measured wave lengths out to 250 a.u. He illustrated application of the Balmer series and the demands of modern theories of modern atomic structure. He pointed out the change in the helium spectrum which was produced by ionization, and stated that with increasing ionization the spectral series moves towards the extreme ultra-violet. The lecturer discussed Millikan's brilliant work in the Schumann region and used it to test the validity of the Mosley rule connecting the atomic principle and the X-ray radiation of different substances. He finally pointed out the fundamental character of research work in the field of the extreme ultra-violet.

Thursday, February 25, 1926: Professor Malcolm MacLaren, Chairman of the Department of Electrical Engineering, Princeton University, read a paper on "The Interpole Motor in Theory and Practice." He gave an interesting historical sketch of the development of the direct current motor from the days of Faraday on, and pointed out the reasons for the particular type of motor under consideration. He showed the necessities for regulation of the motor and stabilization of the magnetic field which led to the particular type. This was followed by a review of the characteristics of the interpole motor and of the favorable results which are gotten by means of it.

Thursday, March 4, 1926: A joint meeting of the Philadelphia Section of the American Society of Civil Engineers and The Franklin Institute was substituted for the regular weekly meeting of the Institute alone. The meeting was the final one of a series devoted to the engineering features of the Delaware River Bridge. Three papers were read by engineers responsible in the design and construction of the bridge for the particular phase of the work discussed. "The Erection of the Suspended Structure" by R. G. Cone, "The Cable Calculations" by G. M. Rapp, and "The Construction of the Cables" by H. D. Robinson. The three papers were authoritative, complete and admirably written. They were splendidly illustrated by diagrams made in connection with the bridge and photographs taken of the work. Mr. Robinson who spoke first, described exhaustively, the procedure followed in the laying of the cables.



its scientific and economic significance; indicated the conditions as to pressure, temperature, etc., which must be met in order to solve certain difficult problems; and discussed the possibility of the use of a catalytic agent in increasing the product of cracking. He stated there were three fundamental processes in cracking: the vapor phase process; the liquid phase process; and a catalytic process. Of these the second was used in the bulk of present-day methods, which number twenty-six in all. He outlined the varying steps of the different methods in practice, showing in much detail how these various processes differed among themselves. In conclusion he said that 'cracked' or 'synthetic' gasoline is just as good as 'straight run' gasoline and even that there was reason for the opinion that, judged by its performance, cracked gasoline is better than the 'straight run' product.

Thursday, April 1, 1926: Mr. W. A. Bentley of Jericho, Vermont, who has been photographing snow crystals for forty years, with apparatus designed and made by him, gave a remarkable display of photographs of water forms and snow flakes, which he had taken about his home in Vermont. He threw upon the screen scores of the many thousands of snow flakes which he has photographed. Some of these pictures had been taken in the immediately preceding winter and therefore represented the latest fashions in snow flakes.

Thursday, April 8, 1926: Professor H. F. Moore, of the Material Testing Laboratory of the University of Illinois, read a scholarly paper, with abundant illustrations, on "Mechanism of Fatigue Failure of Metals." He first showed what was meant by the term, illustrating by photographs some of the effects of fatigue phenomena, and then represented the methods by which such phenomena could be studied. The use of micrographs was next explained and the lessons to be learned from them were illustrated. By the aid of some very striking photographs the lecturer was able to show illustrations of the phenomena of grain growth and indicated how it entered into fatigue phenomena. He then showed by micrographs how cracks had their origin in planes of slip. He finally pointed out the means which might be used to prevent the development of faults in structures.

Thursday, April 15, 1926: Dr. H. H. Kimball read a joint paper by himself and Dr. C. F. Marvin, Chief of the Weather Bureau, United States Department of Agriculture, on "Solar Radiation and Weather Forecasting." These gentlemen had been especially urged to present a statement of the scientific principles underlying weather forecasting, and also a statement of their opinions based upon scientific developments of long range weather forecasting. The paper which was presented was written in order to comply with this request of the Secretary. The speaker of the evening first paid a tribute to the marked scientific work of Doctor Abbott of the Smithsonian Institution, and then made it clear that the Smithsonian has no part in weather forecasting as it is generally understood. He then showed the various instruments which are in use to-day for measurement of intensity of solar radiations; showed the effect of atmospheric transmission upon the value of the solar radiation which is obtained, and then summarized the calculation of the final value of the solar constant as it is based upon the data obtained. Doctor Kimball then showed the connection that would exist between variability of the solar constant and fluctuation of weather conditions. At the end of his talk the speaker



countless products which may be gotten by the distillation of coal, and reviewed the developments and improvements which have been introduced into the industry in recent years. The second speaker, Mr. Caracristi, gave in outline a description of various low temperature processes which have been tried out, and then spoke in detail of the plant which had been installed by him under the leadership of Mr. Henry Ford of Detroit. He spoke especially of the generous support which had been rendered by Mr. Ford. Doctor Brooks in closing the meeting, gave an extensive review and comparison of low temperature processes as used in America and in Europe. The meeting was felt to be a marked success and the papers to have been of high value.

The annual Medal Day exercises were held on Wednesday, May twelfth, at which the medals awarded during the year were presented. A full description of the exercises appears on pages 207 ff. of the JOURNAL of The Franklin Institute, Volume 202.

The formal presentation of the portrait of Samuel Insull to The Franklin Institute was made at a special meeting held in the Hall of the Institute on May twenty-first. The exercises are described in full on pages 223 ff. of the JOURNAL of The Franklin Institute, Volume 202.

Respectfully submitted,

HOWARD McCLENAHAN,

PHILADELPHIA, January 12, 1927.

*Chairman.*

## REPORT OF THE COMMITTEE ON MEMBERSHIP

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the Board of Managers of The Franklin Institute:*

During the fiscal year ending September 30, 1926, one hundred and four members were enrolled in all classes of membership. Resignations were received and accepted from twenty members. Deaths of twenty-five members were recorded. The detail as to elections, resignations and deaths for the year is as follows:

Elections .....	104
Resignations .....	20
Deaths .....	25

### SUMMARY:

Elections .....	104
Resignations .....	20
Dropped for non-payment of dues .....	18
Deaths .....	25

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Net increase in membership ..... 41

### Membership of the Institute by Classes, September 30, 1926:

Resident Members .....	543
Non-resident Members .....	602
Life Members .....	189
Honorary Members .....	31
Associate Members .....	8
Second-class Stock Members .....	20

Corresponding Members .....	2
Contributing Members .....	54
Student Members .....	2
	<hr/>
	1451

From the figures above it will be noted that a considerable increase has been made in membership, and during the last three months of 1926 a great number of additional members were enrolled, a total of 35 for the three months.

By the creation of two new classes of membership during the year 1925, namely, contributing Members and Student Members, greater interest in the Institute has been awakened, which had its effect on the year 1926. A committee especially appointed in the autumn months of 1925 for the purpose of increasing the membership of the Institute and extending its usefulness prepared a circular, which gives in readable form an outline of the history of the Institute and shows what it has done for the City and State. This circular, together with a circular letter to which is attached the names of nineteen citizens of Philadelphia, was used at the booth of the Institute at the Sesqui-Centennial and given to any person desiring information concerning the activities of the Institute or the conditions of membership in it. This literature is also being sent out in response to all inquiries which come in to any of the officers concerning membership.

Nothing in the nature of a campaign for membership is being conducted, but a few members of the Board of Managers of the Institute have by personal effort obtained a considerable number of new members. It is hoped that a continuance of this activity may lead to even more successful results.

Respectfully submitted,

R. W. LESLEY,  
*Chairman.*

PHILADELPHIA, January 12, 1927.

## REPORT OF THE COMMITTEE ON FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the Board of Managers of The Franklin Institute:*

The Committee presents the following statement:

### THE FRANKLIN INSTITUTE

#### PROPERTY AND FUNDS

Building and Land, 13-17 South Seventh Street .....	\$ 60,000.00	
Library .....	100,000.00	\$160,000.00
	Principal.	Unexpended Income.
Funds held by Board of Managers .....	\$651,159.34	
Franklin Institute Building Fund .....	586,828.15	
Elliott Cresson Medal Fund .....	3,000.00	1,181.77
Franklin Fund and Building Committee..	18,606.79	
	<hr/>	<hr/>
	\$1,259,594.28	\$2,762.49
		<hr/>
		\$1,262,356.77
		<hr/>
		\$1,422,356.77

LIABILITIES

Certificates of Stock .....	\$28,694.00
Bills Payable .....	54,500.00
Vouchers Payable .....	3,441.68
Unearned Income .....	112.50
	<hr/>
	\$86,748.18

STATEMENT OF INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED  
SEPTEMBER 30, 1926

Membership Dues:	INCOME	
Resident .....	\$7,800.00	
Contributing .....	825.00	
Non-Resident .....	2,905.00	
Second-class Stock .....	216.00	
Associate .....	55.00	\$11,801.00
	<hr/>	
Initiation Fees .....		180.00
B. H. Belfield Memorial Fund .....		263.44
James H. Cresson Fund .....		2,240.81
General Endowment Fund .....		19,601.18
John H. Towne Memorial Fund .....		182.22
John H. Wahl Memorial Fund .....		4,730.87
Estate of John Turner .....		157.06
Estate of Robert Wright .....		2,238.26
Publications—Subscriptions and Sales .....	\$4,053.11	
Advertising .....	6,112.07	10,165.18
	<hr/>	
Thomson Lectures .....		1,385.77
“Physics of the Air” .....		250.00
Miscellaneous Income and Expense .....		681.75
		<hr/>
Total Income .....		\$53,877.54

EXPENSES

Building—Wages .....	\$1,887.74	
Repairs and Maintenance .....	510.08	
Taxes, Water Rent and Insurance .....	329.71	
Heat, Light and Power .....	796.81	
Miscellaneous Supplies and Expenses .....	337.47	\$3,861.81
	<hr/>	
Instruction, Salaries and Annuities .....		177.08
Library—Salaries .....	\$11,371.98	
Books and Periodicals .....	2,035.27	
Binding .....	1,347.05	
Miscellaneous Expense .....	612.38	15,366.68
	<hr/>	
Meetings .....		4,042.22



# THE FRANKLIN INSTITUTE

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Office and General—Salaries .....	\$14,115.64	
Office Expense .....	1,403.44	
General Expense .....	1,319.87	
Auditor .....	300.00	17,138.95
<hr/>		
Publication—Printing .....	\$12,461.09	
Illustrating .....	2,606.55	
Miscellaneous Expense .....	690.60	
Year Book .....	957.14	
Reprints .....	760.46	17,475.84
<hr/>		
Science and the Arts .....		4,165.32
Interest and Discount .....		2,658.23
Badges and Certificates .....		48.40
Samuel Insull Portrait Account .....		271.14
		<hr/>
Total Expenses .....		\$65,205.67
		<hr/>
Deficit .....		\$11,328.13
		<hr/>

Notwithstanding the operating deficit of \$11,328.13 as shown above, there was during the year a net increase of assets over liabilities amounting to—\$7,689.84.

## THE BARTOL RESEARCH FOUNDATION

FUNDS		
	Principal.	Unexpended Income.
Bartol Principal .....	\$1,268,811.41	
Bartol Accumulated Income .....	397,774.55	
<hr/>		<hr/>
		\$1,666,585.96

LIABILITIES	
Vouchers Payable .....	\$8,710.07

### STATEMENT OF INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED SEPTEMBER 30, 1926

INCOME	
Bartol Principal .....	\$66,267.40
Bartol Accumulated Income .....	23,158.92
Interest .....	596.17
<hr/>	
Total Income .....	\$90,022.49

EXPENSES	
Building—Wages .....	\$2,333.75
Taxes, Water Rent and Insurance .....	133.59
Heat, Light and Power .....	2,518.62

Supplies .....	442.17	
Miscellaneous Expenses .....	194.14	\$5,622.27
<hr/>		
Library—Salaries .....	\$600.00	
Books and Periodicals .....	739.13	
Miscellaneous .....	.05	\$1,339.18
<hr/>		
Office Expense—Salaries .....	\$7,653.51	
Stationery and Supplies .....	259.11	
Miscellaneous Expenses .....	717.46	\$8,630.08
<hr/>		
Laboratory Supplies .....		\$4,454.67
Machine Shop Supplies .....		1,610.93
Travelling Expenses .....		1,008.12
Salaries Research Professors and Mechanics .....		11,662.29
Commissions for Collection of Income .....		1,779.93
Contingent Expenses .....		1,144.48
Honoraria of Advisory Committee .....		2,479.13
Auditor .....		325.00
Lectures .....		1,155.33
Publications—Printing .....		638.52
<hr/>		
Total Expenses .....		\$41,849.93
Surplus .....		\$48,172.56
<hr/>		

Respectfully submitted,

WALTON FORSTALL,  
Chairman.

PHILADELPHIA, January 12, 1927.

## REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

*To the Board of Managers of The Franklin Institute:*

Since our last report, a marked change in the appearance of the JOURNAL of The Franklin Institute was effected by the adoption of a new cover, which was first used in January, 1926, on Volume 201, Number I, and which, it is presumed, will be used indefinitely. Many favorable comments commending the Committee upon the appearance of the JOURNAL, have been received.

The most important feature of the publication of the JOURNAL of The Franklin Institute during the latest Institute year was the number of contributions made to the JOURNAL by the men working at the Bartol Research Foundation Laboratories. It is, of course, the policy of the Institute to publish in its JOURNAL all of the work of value done at the Laboratories. During the last year five such articles were printed. These articles are given the right of way in all the JOURNALS and are published without delay, immediately after they are presented by the authors of them. This is, of course, a great advantage to our own men, as they have in the JOURNAL an immediate and sure agency for publication of their work.

The Committee in charge of the Bartol Research Foundation recognizes the value of this advantage and therefore pays towards the expenses of printing of the JOURNAL a sum proportionate to the amount of printed matter from the Bartol Foundation which appears in the JOURNAL.

During the last year the Committee has considered the policy of the JOURNAL with reference to the use of the Metric System in the articles which appear in the JOURNAL. The editors and the Committee are hearty supporters of the Metric System, yet they recognize that some of our contributors are not accustomed to use the Metric System and would find it an inconvenience to have to do so. The Committee has therefore decided to accept originally contributed articles in whatever system the measurements may be expressed. In all of their own editorial comments or writings, the Metric System alone is to be used; while in references or quotations from other periodicals in which the English System is used, any measurements given are to be expressed in terms of the Metric System, with the equivalent English unit in parenthesis immediately following.

During the year a hundred and twenty-two copies of Doctor Humphreys' book, "Physics of the Air" were sold. During the same period one hundred and seventy-one copies of Dr. J. J. Thomson's "Electron in Chemistry" have been sold.

A statement of the Financial operations of the Committee for the year follows:

JOURNAL:	EXPENSES	
Printing .....	\$13,036.47	
Illustrations .....	2,653.70	
Miscellaneous .....	690.60	
Year Book .....	1,200.64	
Reprints .....	1,711.47	
Total Expenses .....		\$19,292.88
JOURNAL:	INCOME	
Subscriptions .....	\$4,053.11	
Advertising .....	6,112.07	
Year Book—Advertising .....	243.50	
Reprints—Sales .....	951.01	
Total Income .....		\$11,359.69
Net Cost .....		\$7,933.19

It should again be pointed out that these figures of the Publications Committee account contain no portion of the dues paid by members who receive the JOURNAL, without any payment other than the annual dues. This is probably merely a matter of bookkeeping, however, as the deficit is paid out of the income of the Institute, to which the dues are credited.

Respectfully submitted,

E. H. SANBORN,  
Chairman.

PHILADELPHIA, January 12, 1927.

## REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING JANUARY 31, 1927

*To the President and Members of The Franklin Institute:*

With the closing of the year 1926 the ninety-second year of the existence of the Committee on Science and the Arts ended.

The work of the Committee during this year included the investigation of seventeen cases with their final disposition and of eleven new cases which are now pending.

Seventeen awards were made as a result of these investigations. Reference to the appendix to this report will show the details of the awards.

In the death, on February 22, 1926, of Mr. William H. Thorne, the Committee on Science and the Arts lost a member who had rendered a valued service for many years. His term of membership was unusually long, preparations having been made to recognize (at the next meeting of the Committee after his death) the fiftieth anniversary of his becoming a member of the Committee.

The Sub-Committee on New Subjects and Preliminary Examination held nine stated meetings during the year at which fifty-one subjects were considered. Twelve of these were recommended for investigation and applications were received from eight of them. Eight special cases were also recommended for investigation for which no application was required. These recommendations were accepted by the General Committee and sub-committees of investigation were appointed.

The Standing Sub-Committee on Literature and The Franklin Medal met at stated times and recommended the award of two Louis E. Levy Medals for articles published in the JOURNAL during 1925, and two Franklin Medals. These recommendations were adopted and the medals and accompanying certificates were presented to the recipients by the President of the Institute at the Stated Meeting in May.

Mr. Constantin Brun, Minister of Denmark, was present to receive the Franklin Medal awarded to Professor Niels Bohr, of Copenhagen, Denmark; Dr. Samuel Rea, of Philadelphia, was present to receive the Franklin Medal awarded to him; Professor Charles S. Hastings, of Yale University, to receive the Elliott Cresson Medal. The Elliott Cresson Medal awarded to Doctor George Ellery Hale, Honorary Director of Mount Wilson Observatory, was handed, in Doctor Hale's absence, to Doctor McClenahan, Secretary of the Institute, for transmission to Doctor Hale.

In the absence of Professor Ernest G. Coker, of the University of London, Mr. Frederic Watson, British Consul General, received the Levy Medal awarded to Professor Coker, for transmission to him. The Levy Medal was also presented to Mr. Frank W. Peek, Jr., of Pittsfield, Massachusetts.

The Wetherill Medal awarded to Mr. Frank Twyman of London, England, was, in his absence, received by Mr. Watson for transmission. A second Wetherill Medal awarded to the Wagner Electric Corporation, of St. Louis, Missouri, was received by its representative, Mr. E. W. Goldsmidt.

The Longstreth Medal awarded to Mr. James J. Denny, of Schumacher, Ontario, Canada, was, in his absence, received by Mr. Watson for transmission to Mr. Denny.

Eighteen of the twenty members of the Committee whose term of membership expired in January were reëlected and the following new members were elected to fill vacancies.

MR. N. W. AKIMOFF

MR. WILLIAM L. BROWN, 3RD

An outstanding event of the year was the presentation to the Institute by the United Gas Improvement Company, of a fund for the establishment of the Walton Clark Gold Medal. In presenting this fund the donors state:

"The income from this investment is to be used to provide a medal to be awarded by the Institute, not more frequently than once a year, to the author of the most notable advance in knowledge or improvement in apparatus, or in method concerning the science or the art of gas manufacture or distribution or utilization in the production of illumination, or of heat, or of power."

The first award of the Clark Medal was made to Doctor Walton Clark on the afternoon of Tuesday, December 21st. This award was made on the recommendation of the Committee on Science and the Arts in consideration of Doctor Clark's life work in the American gas industry and his distinguished and outstanding contributions to technical progress in that industry.\*

Valuable service was rendered by a number of the members of the Committee in acting as members of the various juries of award at the Sesqui-Centennial International Exposition. Officials of the Exposition have expressed their appreciation.

The character of this service may be judged by the fact that Mr. James S. Rogers was made Chairman and Mr. Harold Calvert, Secretary, of the Group Jury, before which cases came for final decision.

The attendance of members at the meetings of the Committee during the last year has been exceptionally good and the coöperation given by the members to the business of the Committee is fully appreciated.

Respectfully submitted,

CLARENCE A. HALL,  
*Chairman.*

PHILADELPHIA, January 31, 1927.

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\*Dr. Walton Clark, in whose honor this medal was established, is Consulting Engineer of the United Gas Improvement Company, and for the seventeen years prior to 1924 was the President of The Franklin Institute. His labors as President helped greatly to give to the Institute the standing which it has today. Because of his distinguished labors in connection with the United Gas Improvement Company, The Franklin Institute awarded to Dr. Walton Clark the first Walton Clark Medal. The award was made "in consideration of his life work in the American gas industry and his distinguished and outstanding contributions to technical progress in that industry, as a pioneer in the association of chemical and physical laboratories with the developmental work of the gas companies, by his participation through interest, suggestion and advice in the invention of a process for the complete gasification of coal, in the development of processes for operating water-gas sets, and in the institution of beneficial modifications of water-gas apparatus, by numerous articles contributed to the technical press, and by his unflinching interest in the educational progress and the all-round development of the younger men who were fortunate enough to be associated with him."

APPENDIX

Statement of the Committee's Operation from February 1, 1926,  
to January 31, 1927

Cases pending February 1, 1926 .....	13
Applications received to January 31, 1927 .....	8
Special Reports .....	8
	<hr/>
	29
Disposed of to January 31, 1927 .....	17
Leaving pending .....	12

AWARDS MADE

Franklin Medal .....	2
Louis E. Levy Medal .....	2
Elliott Cresson Medal .....	3
Howard N. Potts Medal .....	3
John Price Wetherill Medal .....	2
Walton Clark Medal .....	1
Edward Longstreth Medal .....	4
	<hr/>
	17



By the support of the Bartol Foundation, Professor Swann in September last went to Pike's Peak in Colorado and repeated the observations which he had made the previous summer in Norway, in a search for corpuscular radiations of cosmic origin. He spent almost a week on the top of Pike's Peak, setting up his apparatus and making his observations. This was at an elevation of approximately fourteen thousand feet. The same set of observations was then made at Colorado Springs, at an elevation of about seven thousand feet. And then, upon Professor Swann's return to New Haven, Connecticut, these observations were made at sea level. The purpose was, of course, to determine the existence of such radiations in the first place, and in the second place to discover, if possible, the quantitative influence of atmospheric absorption upon any radiations of cosmic origin which might be detected. The results of these researches are to be published shortly.

The work of the Bartol Laboratories has been carried on under the general supervision of the Bartol Research Foundation Committee, composed of Dr. W. C. L. Eglin, President of the Institute, Dr. Walton Clark, former President of the Institute; Mr. Marshall Morgan; Mr. Nathan Hayward; Mr. Charles Penrose; and Professors Swann and Adams; Dean Joseph S. Ames, Johns Hopkins University; Dr. Arthur L. Day, Director of the Geophysical Laboratory, Washington, D. C.; President C. R. Richards of Lehigh University and the Chairman, with Dr. Howard McClenahan, Secretary of the Institute serving as an advisory member and the general executive of the Committee. The work of the Foundation has been coördinated with the work of The Franklin Institute as far as possible under the administrative direction of Doctor McClenahan, and it has been found that many economies have been effected and the work greatly facilitated thereby.

An additional machinist has been added to our Machine Shop staff, making three in all, and a glass blower now working on full time has added greatly to the success of the work carried on, since such work requires much special apparatus of more or less intricate design, most of which is now being made in our shop.

The financial statement (page 89) of the Bartol Foundation shows that during the last year nearly fifty thousand dollars were added to the capital fund of the Foundation. During the preceding year a somewhat larger sum was added to the capital, so that during the past two years the invested funds of the Bartol Foundation have been increased by somewhat more than a hundred thousand dollars.

During the past year four series of lectures have been delivered on the Bartol Foundation by scientists of standing in the United States and England. Dr. E. O. Hulburt of the Naval Research Laboratory, Washington, D. C., gave three lectures on "The Kennelly-Heaviside Layer and Radio Wave Propagation"; "Hydrogen Spectrum Lines in the Stars and in the Laboratory"; "The Pressure of Light on Electrons." Dr. L. W. McKeehan of the Bell Telephone Laboratories, Inc., New York City, delivered a course of three lectures on "Magnetostriiction." Professor R. Whiddington, Cavendish Professor of Physics, University of Leeds, England, read a paper on "The Luminous Discharge Through Rare Gases." And Professor R. C. Tolman, Professor of Physical Chemistry and Mathematical Physics, California Institute of Techn-



ology, presented three papers on "Statistical Mechanics and Its Application to Physical-Chemical Problems." All of the lectures were greatly appreciated and have been published or will be published in the JOURNAL of the Institute.

In accordance with the policy of the Foundation and the Institute, eight articles appeared in the JOURNAL of the Institute from the Bartol Foundation. Three of these were by Dr. Bramley, the first Fellow; the three lectures by Dr. Hulburt; one article upon the three lectures by Dr. McKeehan; and two communications from Dr. H. J. Brennen.

Plans are under way, the completion of which will greatly facilitate and extend the work of the Foundation. In conclusion I wish to thank the individual members of the Bartol Committee for their support and unfailing interest in the progress of the work and to commend the employees of the Foundation for the loyal and cheerful performance of their duties.

Respectfully submitted,

C. C. TUTWILER,  
*Chairman.*

PHILADELPHIA, January 12, 1927.

# THE FRANKLIN INSTITUTE AWARDS

FEBRUARY 1, 1926 TO JANUARY 31, 1927

## THE FRANKLIN MEDAL

TO

Professor Niels Bohr, of Copenhagen, Denmark, "in recognition of his epoch-making contributions to the mechanics of atomic structures and for the brilliant results attained by application of his theory regarding the origin of spectrum lines."

Dr. Samuel Rea, of Philadelphia, Pennsylvania, "in recognition of his outstanding work in the conception and construction of railroads, their terminals, tunnels and bridges, and of his eminently successful application of the principles of science, economics and human relations to railway engineering and administration, in which he displayed vision, imagination and courage of high order."

## THE ELLIOTT CRESSON MEDAL

TO

Dr. George Ellery Hale, of Pasadena, California, in recognition of his outstanding researches and fundamental discoveries relating to the sun and the solar atmosphere.

Dr. Charles S. Hastings, of New Haven, Connecticut, in recognition of his scientific attainments and of his originality and skill in the design and computation of optical systems of the highest order.

## THE LOUIS EDWARD LEVY MEDAL

TO

Professor E. G. Coker, of London, England, for his paper entitled "Photo-Elasticity" in the JOURNAL.

Mr. F. W. Peek, Jr., of Pittsfield, Massachusetts, for his paper entitled "Lightning" in the JOURNAL.

## THE HOWARD N. POTTS MEDAL

TO

Dr. W. D. Coolidge, of the General Electric Company, Schenectady, New York, for his inventions embodied in the Coolidge X-ray tube.

Mr. Howard W. Matheson, of Shawinigan Falls, Canada, for his inventions embodied in his Process for the Conversion of Acetylene to Acetaldehyde and Its Oxidation to Acetic Acid.

## THE JOHN PRICE WETHERILL MEDAL

TO

Dr. Carl Akeley, of New York City, N. Y., for his inventions embodied in the Akeley Motion Picture Camera.

THE WALTON CLARK MEDAL

TO

Dr. Walton Clark, of Philadelphia, Pennsylvania, in recognition of his distinguished and outstanding contributions to the technical progress of the gas industry.

THE EDWARD LONGSTRETH MEDAL

TO

Mr. James J. Denny, of Cobalt, Canada, for his inventions embodied in "Linerite," a rubber lining for grinding mills.

Mr. Alonzo G. Kinyon, of Fullerton, Pennsylvania, for his inventions embodied in the Fuller-Kinyon Conveying System for Pulverized Materials.

# **AWARDS**

**1856-1927**

## **FRANKLIN MEDAL AWARDS**

**1915-1927**

**ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.**

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

**BOHR, NIELS, PH.D.**

"In recognition of his epoch-making contributions to the mechanics of atomic structures and for the brilliant results attained by application of his theory regarding the origin of spectrum lines."

1926.

**CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.**

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

**DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.**

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

**EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.**

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

**FABRY, CHARLES, D.Sc.**

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FRANKLIN MEDAL AWARDS

FERRIÉ, AUGUSTE GUSTAVE, GENERAL.

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization and directing of the communication service of the French Army during the World War."

1923.

LORENTZ, HENDRICK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate constitution of matter."

1917.

MARCONI, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

MICHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."

1923.

MODJESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ONNES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

## FRANKLIN MEDAL AWARDS

PARSONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

REA, SAMUEL, Sc.D., LL.D.

"In recognition of his outstanding work in the conception and construction of railroads, their terminals, tunnels and bridges, and of his eminently successful application of the principles of science, economics and human relations to railway engineering and administration, in which he displayed vision, imagination and courage of high order."

1926.

RICHARDS, THEODORE WM., A.M., Ph.D., Sc.D., LL.D., Chem.D., M.D., F.C.S.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

RUTHERFORD, SIR ERNEST, Kt., D.Sc., LL.D., Ph.D., D.Phys., F.R.S.

"In recognition of long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships."

1924.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., Ph.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the U. S. Navy."

1917.

## FRANKLIN MEDAL AWARDS

THOMSON, ELIHU, PH.D., Sc.D., LL.D.

"In recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields."

1925.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science, especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

WESTON, EDWARD, LL.D., Sc.D.

"In recognition of discoveries and inventions in the field of electricity, immeasurably fruitful and fundamentally contributory to the establishment of the electric art."

1924.

ZEEMAN, PIETER, PH.D., Sc.D.

"In recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source."

1925.

## CRESSON MEDAL AWARDS

1856-1927

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

## CRESSON MEDAL AWARDS

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.  
Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H. AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHERE, NORBERT.

Machine for Treating Flax.—1879.



## CRESSON MEDAL AWARDS

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

System of Machine Telegraphy.—1896.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

## CRESSON MEDAL AWARDS

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUT.

Electric Motor and Battery.—1881.

HADFIELD, SIR ROBERT A.

Advancement of Metallurgical Science.—1910.

HALE, GEORGE ELLERY.

Discoveries Relating to the Sun and the Solar Atmosphere.—1926.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HASTINGS, CHARLES S.

Originality and Skill in the Design and Computation of Optical Systems.—1926.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HODGKINSON, FRANCIS.

Turbo-electric Appliances.—1925.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

## CRESSON MEDAL AWARDS

LANSTON, T.

Monotype Machine.—1896.

LEVY, L. E.

Acid Blast Method and Apparatus for Etching Metal Plates.—1900.

Machine for Powdering Plates for Etching.—1904.

LEWIS, COL. ISAAC NEWTON.

Machine Gun.—1918.

LINDE, KARL P. G.

Refrigeration Processes.—1914.

LOWE, THADDEUS S. C.

Water Gas Process and Apparatus.—1886.

LOVEKIN, L. D.

Expanding and Flanging Machinery and Tools for all Classes of Tubes.—  
1904.

LUMIÈRE, AUGUSTE AND LOUIS.

Color Photography.—1909.

MALLET, A.

Articulated Compound Locomotive.—1908.

MARKS, G. E.

Improvements in Artificial Limbs.—1893.

MASON AND HAMLIN COMPANY.

Liszt Organ.—1901.

MERGENTHALER, O.

Linotype.—1889.

MICHELSSEN, A. A.

Work in Physical Optics.—1912.

MILLER, DAYTON C.

Fundamental Investigations in Acoustics.—1926.

MOISSAN, HENRI.

Investigations with the Electric Furnace.—1898.

MORLEY, E. W.

Determination of Fundamental Magnitudes in Chemistry.—1912.

NOBLE, ALFRED.

Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E., JR.

Molecular Structure of Cast Iron.—1904.

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MORLEY, E. W.

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NOBLE, ALFRED.

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OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E., JR.

Molecular Structure of Cast Iron.—1904.

## CRESSON MEDAL AWARDS

OWENS, MICHAEL J.

Bottle Blowing Machine.—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART, and COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, SIR ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

SAUVEUR, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signaling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

## CRESSON MEDAL AWARDS

- SPELLIER, LOUIS H.  
Time Telegraph.—1881.
- SPRAGUE, F. J.  
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.  
Multiplex Telephony.—1912.
- STEINMETZ, C. P.  
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.  
Leading Work in Metrology.—1912.
- TALBOT, B.  
Open Hearth Steel Process.—1909.
- TATHAM, W. P.  
Printing Press.—1875.
- TAYLOR, E. R.  
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.  
Process of Treating Tool Steel.—1902.
- TESLA, NIKOLA.  
Alternating Electric Currents of High Frequency.—1894.
- THOMSON, ELIHU.  
Industrial Applications of Electricity.—1912.
- THOMSON, JOSEPH J.  
Leading Work in Physical Science.—1910.
- TILGHMAN, B. C.  
Sand Blast.—1875.
- TURNER, W. V.  
Air Brake Design and Application.—1909.
- U. S. GEOLOGICAL SURVEY.  
Exhibit of Survey.—1900.
- UNDERWOOD TYPEWRITER COMPANY.  
Typewriter.—1909.
- VAUCLAIN, S. M.  
Compound Locomotive.—1891.
- VERNAZ, ALEXIS.  
Milling Files.—1909.
- VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.  
Spindle Support.—1891.
- WALKUP, L.  
Air Brush.—1886.
- WATERHOUSE, A. G., AND FORBES, JOHN S.  
Art of Automatically Heating and Sterilizing Fluids.—1901.

## CRESSON MEDAL AWARDS

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901.

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

"Econometer."—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

## POTTS MEDAL AWARDS

1911-1927

ANDERSON, JOHN A.

Work in Spectroscopy and his Seismograph.—1924.

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BEGGS, GEORGE E.

Method and Apparatus for Determining Stresses.—1926.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-elastic Means.—1922.

COOLIDGE, W. D.

X-ray Tube.—1926.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.



## POTTS MEDAL AWARDS

GAERTNER, WILLIAM.

Design and Manufacture of Scientific Instruments.—1923.

GRAY, ALEXANDER.

“Modern Dynamo Electric Machinery” (Paper).—1918.

HULL, ALBERT W.

“The Crystal Structure of the Common Elements” (Paper).—1923.

HUMPHREYS, WILLIAM J.

“The Thunderstorm and Its Phenomena” (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-wire Anemometer.—1918.

KING, LOUIS V.

Improvement in Linear Hot-wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

“Plants and Relation to Nitrate in Soils” (Paper).—1912.

MATHESON, HOWARD W.

Process for the Conversion of Acetylene.—1926.

MCCOLLUM, E. V.

“Nutrition and Physical Efficiency” (Paper).—1921.

MODJESKI, RALPH.

“Design of Large Bridges with Special Reference to Quebec Bridge” (Paper).—1914.

MOORE, RICHARD B.

“Helium, its History, Properties and Commercial Development” (Paper).—1922.

MURRAY, W. S.

“Conditions Affecting the Success of Main Line Electrification” (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

WILSON, C. T. R.

Making the Tracks of Ionizing Rays Visible and Capable of Permanent Record by Photography.—1925.

**LEVY MEDAL AWARDS****1924-1927****COKER, E. G.**

"Photoelasticity."—1926.

**FLETCHER, HARVEY.**

"Physical Measurements of Audition and Their Bearing on the Theory of Hearing."—1924.

**HAYES, HARVEY C.**

"Measuring Ocean Depths by Acoustical Methods."—1925.

**PEEK, F. W.**

"Lightning."—1926.

**WALTON CLARK MEDAL AWARDS****1926-1927****CLARK, WALTON.**

Distinguished Contributions to the Gas Industry, Especially the Association of Chemical and Physical Laboratories with the Developmental Work of the Gas Companies.—1926.

**WETHERILL MEDAL AWARDS****1925-1927****AKELEY, CARL.**

Motion Picture Camera.—1926.

**NORTHEAST ELECTRIC COMPANY.**

Electric Power Drive for Typewriters.—1926.

**TWYMAN, FRANK.**

Inventions Embodied in the Hilger Interferometer.—1925.

**WAGNER ELECTRIC CORPORATION.**

The Fynn-Weichsel Motor.—1925.

**LONGSTRETH MEDAL AWARDS****1890-1927****ABBE, C.**

"Meteorology" (Paper).—1913.

**ABBOTT, ROBERT R.**

"Modern Steels and Their Heat Treatment" (Paper).—1916.

**ACHARD, F. H., KENNELLY, A. E., AND DANA, A. S.**

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

**ADAMS, L. H., AND WILLIAMSON, E. D.**

"The Annealing of Glass" (Paper).—1921.

## LONGSTRETH MEDAL AWARDS

- ADAMS, W. G., AND FORBES, J. S.  
Stop Valve for Radiators.—1893.
- ALEXANDER, JOHN E.  
"Phonosphere."—1905.
- ALTENEDER, THEODORE, AND SONS.  
Drawing Pen.—1905.
- ARMSTRONG, WM. T., AND COX, JACOB D.  
Grip Socket.—1896.
- ARNOLD, B. J.  
Magnetic Clutches and System of Electric Power Station Construction.—1903.
- AUSTIN, JOHN T.  
Austin Organ.—1917.
- BALL, JOHN D.  
"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.
- BASKERVILLE, C.  
"Chemistry of Anæsthetics" (Paper).—1912.
- BATES, E. G.  
Typographic Numbering Machine.—1895.
- BAUSH, CHRISTIAN H.  
Radial Drilling Machine.—1894.
- BECKER, CHRISTOPHER A.  
Chainomatic Balance.—1917.
- BENNETT, CHARLES A.  
Typewriter.—1909.
- BERGONIE, J.  
Use of A. C. Electro-magnet in Surgery.—1921.
- BLOEDE, V. G.  
Process of Tinting Fabrics.—1894.
- BONNELL, RUSSELL, AND SCHMITT, HENRY J.  
Gate Valves.—1901.
- BRADBURN AND PENNOCK.  
Process of Obtaining Alumina from Bauxite.—1893.
- BRANDT, EDWARD J.  
Automatic Cashier.—1922.
- BREED, G.  
Apparatus for Producing Musical Sounds by Electricity.—1908.
- BRISTOL, W. H.  
Recording Pressure Gauge.—1894.
- BROWN, HAROLD P., AND EDISON, THOMAS A.  
Rail Bonds and Electrical Contacts.—1899.
- CAFFREY, C. S., AND COMPANY.  
Improvement in Carriages and Wagons.—1900.

## LONGSTRETH MEDAL AWARDS

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

"Continuous Electric Oscillations" (Paper).—1913.

CHANCE, E. M.

"Pathogenic Mine Atmospheres" (Paper).—1912.

CHANCE, THOMAS M.

Apparatus for Separating Materials of Different Specific Gravities.—1925.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Ventilating Stove.—1894.

COLLINS, FRANK W., AND CLARK, WM. H.

Ventilating Stove.—1894.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete" (Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

"Researches on the Corrosion of Iron and Steel" (Paper).—1908.

DANA, A. S., KENNELLY, A. E., AND ACHARD, F. H.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

DENNY, JAMES J.

Rubber Lining for Grinding Mills.—1926.

DESHLER, CHARLES, AND MCALLISTER, EDWARD J.

Portable Photometer.—1900.

DEVÖE, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

## LONGSTRETH MEDAL AWARDS

- EBERHARDT, HENRY F., AND ULRICH, F. L.  
Radial Gang Cutter.—1904.
- EDDISON, WILLIAM BARTON.  
Jet Entraining Apparatus.—1921.
- EDISON, THOMAS A., AND BROWN, HAROLD P.  
Rail Bonds and Electrical Contacts.—1899.
- EDWARDS, LEVI TALBOT.  
Compound Air-Lift System.—1918.
- ELLIOTT, WILLIAM SWAN.  
Process and Apparatus for the Deaeration of Liquids.—1924.
- ELLIS, CARLETON.  
Paint and Varnish Remover.—1916.
- EVE, A. S.  
“Modern Views on the Constitution of the Atom” (Paper).—1916.
- FAY, C. N.; SHOLES, Z. G., AND HOCHKLASSEN, H.  
Typewriting Machine.—1901.
- FOLLETT, W. I.  
Time Stamp.—1906.
- FOLMER AND SCHWING MFG. COMPANY.  
Graflex Cameras.—1905.
- FORBES, J. S., AND ADAMS, W. G.  
Stop Valve for Radiators.—1893.
- FREAS, SAMUEL T.  
“Interlocking” Tooth Saw.—1922.
- FRICK, FRED.  
Electric Program Clock.—1899.
- FULLER, G. W.  
“Biochemical and Engineering Aspects of Sanitary Water Supply”  
(Paper).—1916.
- GOLDMAN, HENRY.  
Arithmachine.—1901.
- GOODYEAR, CHARLES.  
Projection Lantern.—1895.
- GRANBERY, J. H.  
Stadia Rod.—1909.
- HARTNESS, JAMES.  
Screw Thread Comparator.—1922.
- HEILPRIN, A.  
Improved Ventilating Car Window.—1897.
- HENNING, G. C.  
Pocket Recorder for Tests of Materials.—1899.
- HEPBURN, J. S.  
“Chemistry of Sugar” (Paper).—1911.

## LONGSTRETH MEDAL AWARDS

HERR, H. T.

"Development of Steam Turbines" (Paper).—1914.

HICKS, THOMAS WILLING.

"Once-Over" Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N.; AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOKE, WILLIAM E.

Precision Gauge Blocks.—1925.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J., AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER Co.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, F. E.

Photo-micrographic Process.—1903.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, H. E.; KINGSBURY, E. F.; AND KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

## LONGSTRETH MEDAL AWARDS

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KINYON, ALONZO G.

Conveying System for Pulverized Materials.—1926.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDOUX, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; AND HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

Shockless Jarring Machine.—1926.

## LONGSTRETH MEDAL AWARDS

LLOYD, M. G.

“Magnetic Hysteresis” (Paper).—1911.

LODGE, GEORGE.

Electro-magnetic Street Railway System.—1896.

LUCKIESH, M.

“The Visibility of Airplanes” (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MCBRIDE, THOMAS C.

Locomotive Feed Water Heater.—1924.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MELOCHE, DANIEL H.

Molds.—1925.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MIDGLEY, THOMAS, JR.

Optical Indicator.—1925.

MILEY, HENRY M. AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

“A 32-Element Harmonic Synthesizer” (Paper).—1917.

MOORE, RICHARD B.

“Biography of Sir William Ramsay” (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NACHOD, CARL P.

Electric Railway Signal System.—1924.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHROP, E. F.

“Vortex Motion in Liquids” (Paper).—1912.

PANTASOTE LEATHER COMPANY.

“Pantasote.”—1896.

PARKE, HARRY S.

Pneumercator Tank and Draft Gauge.—1923.



## LONGSTRETH MEDAL AWARDS

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W. VON.

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1919.

## LONGSTRETH MEDAL AWARDS

- SCHMIDT, MAX, AND SIEBER, JOSEPH.  
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.  
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.  
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.  
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.  
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.  
Coal Loading and Screening Machines.—1904.
- SHARPLES SPECIALTY COMPANY.  
Super-Centrifuge.—1916.
- SHAW, H. M.  
Lightning Arrester.—1904.
- SHEEN, MILTON ROY.  
Expansion Machine for Tunnel Construction.—1924.
- SHELLENBACH, WILLIAM L.  
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; AND HOCHKLASSEN, H.  
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.  
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.,  
"Soil Aldehydes" (Paper).—1919.
- SMATHERS, FRANK W.  
Power Drive for Typewriters.—1926.
- SNOOK, HOMER CLYDE.  
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.  
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.  
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.  
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.  
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.  
"Propagation of Electric Waves along Wires" (Paper).—1913.
- STRADLING, GEORGE F.  
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.  
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.  
Radojet Air Pump.—1920.

## LONGSTRETH MEDAL AWARDS

TAINTOR, C. C.

Positive Saw-Set.—1895.

TAUSSIG, JOHN H., AND ZEEK, CHARLES F.

Automatic Operation of Water Gas Sets.—1918.

TEAL, B. F.

Anti-friction Universal Joint for Shafting.—1909.

THOMAS, C. C.

"Measurement of Gases" (Paper).—1912.

TIERNAN, MARTIN F., AND WALLACE, C. F.

Chlorinator.—1922.

TOERRING, C. J.

Electric Arc Lamp.—1903.

TOWNSEND, T. F.

Improved Thermometer Support.—1907.

TUCKER, W. H.

Letter and Document Files.—1900.

TURNER, W. V.

"Locomotive Air-brake" (Paper).—1911.

TUTWILER, C. C.

"Recovery of Gas Works By-products" (Paper).—1915.

ULRICH, FREDERICK L., AND EBERHARDT, H. E.

Radial-Duplex Gang Cutters.—1904.

UNDERWOOD, JOHN, AND COMPANY.

Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

## LONGSTRETH MEDAL AWARDS

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage"  
(Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN AND ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Sets.—1918.

ZIMMERMANN, WILLIAM F.

Hob for Worm Gears.—1924.

## CERTIFICATE OF MERIT AWARDS

1885-1926

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR-ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

## CERTIFICATE OF MERIT AWARDS

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

COPPAGE, B. DENVER.

Plastometer.—1925.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GRAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD;  
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GRAY, CHARLES B.

Sheet Metal Cutter.—1925.

GREAVES, H. A., AND ETCHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

## CERTIFICATE OF MERIT AWARDS

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO<sub>2</sub> and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; AND ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

CERTIFICATE OF MERIT AWARDS

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

“Aeronautic Instruments” (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a New Food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

“A New Theory of Plate Springs” (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

PROUTY, THEODORE C. and WILLIS O.

Chronometric Tachometer.—1925.

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

## CERTIFICATE OF MEDAL AWARDS

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; AND GENERAL ELECTRIC COMPANY.

Magnetite Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-off for Slide Valve Engines.—1889.



## TERMS AND PRIVILEGES OF MEMBERSHIP

**Members of the Institute** shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. All persons interested in the purposes and activities of the Institute and who are willing to further them, may become members when proposed by members in good standing and elected by the Board of Managers. The membership of the Institute shall consist of the following classes of members; *viz.*: Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Student, and holders of Second Class Stock.

**Honorary and Corresponding members** shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote nor to hold office. All other members shall be elected by the Board of Managers.

**Endowment members** shall consist of persons, firms, corporations or associations who shall make an endowment payment of five thousand dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year, without payment of dues, that number of persons, to be determined from time to time by the Board of Managers, whose annual dues, if they were paying annual Resident Membership dues, would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise; provided, however, that the Board of Managers at any time may refund five thousand dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

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**Resident Life members**, whose membership shall not be transferable, are those members who shall pay the sum of three hundred dollars in any one year.

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*Resignations must be made in writing, and dues must be paid to the date of resignation.*

**Membership Badges.**—Pin or button form, may be purchased from the Controller for One Dollar. All badges are numbered and the owner's name and number recorded.

For further information and membership application blanks address the SECRETARY OF THE INSTITUTE.

## MEETINGS AND LECTURES

1926-1927

- Wednesday, October 20. Dr. W. D. Coolidge, Laboratories of the General Electric Company, Schenectady, New York, "The Production of High Voltage Cathode Rays Outside of the Generating Tube."
- Thursday, October 28. Meeting in celebration of "Management Week."
- Thursday, November 4. William F. Parish, Esq., Consulting Lubrication Engineer, New York City, "The Distillation of Petroleum for the Manufacture of the Lubricating Oils."
- Thursday, November 11. Howard T. Barnes, D.Sc., Professor of Physics, McGill University, "Thermit and Icebergs."
- Wednesday, November 17. Richard C. Tolman, Ph.D., Professor of Physical Chemistry and Mathematical Physics, California Institute of Technology, "Statistical Mechanics and Its Application to Physical-Chemical Problems."
- Thursday, December 2. Hugh Stott Taylor, D.Sc., Professor of Physical Chemistry, Princeton University, "Atomic Hydrogen and the Mechanism of Catalysis."
- Thursday, December 9. John Quincy Stewart, Ph.D., Professor of Astronomical Physics, Princeton University. "Hypotheses Regarding the Source of the Energy of Sun and Stars."
- Wednesday, December 15. Nevin E. Funk, Operating Engineer, Philadelphia Electric Company, Philadelphia, Pa., "Unusual Engineering Features of the Conowingo Dam and Power Plant."
- Thursday, January 13. Bergen Davis, Ph.D., Department of Physics, Columbia University, "Refraction of X-rays."
- Wednesday, January 19. Thomas Midgeley, Jr., Esq., Research Chemist, Dayton, Ohio, "Anti-Knock Motor Fuel."
- Thursday, January 27. George W. Morey, Ph.D., Geophysical Laboratory, Washington, D. C., "The Chemical Basis of Glass Technology."
- Thursday, February 3. L. B. Stiles, C.E., Construction Engineer, The Brooklyn Union Gas Company, "The Gowanus Canal Pipe Tunnel."
- Thursday, February 10. Wolfgang Klemperer, Esq., Akron, Ohio, "Soaring Flight."
- Wednesday, February 16. B. S. Hopkins, Ph.D., Department of Chemistry, University of Illinois, "Illinium."
- Thursday, February 24. H. B. Williams, Ph.D., College of Physicians and Surgeons, Columbia University, "Physical Instruments in Medical Service."
- Thursday, March 3. J. H. Dellinger, Ph.D., Senior Physicist, Bureau of Standards, Dept. of Commerce, Washington, D. C., "Directive Radio Transmission."
- Thursday, March 10. L. P. Alford, Editor, "Manufacturing Industries," New York City, "Safety and Production."

- Wednesday, March 16. C. H. Kunsman, Ph.D., Physicist, Fixed Nitrogen Research Laboratory, Bureau of Soils, Department of Agriculture, Washington, D. C., "The Thermionic Emission From Iron Alkali Mixtures Used as Catalysts in the Synthesis of Ammonia."
- Thursday, March 24. Robert H. Gault, Ph.D., Director, Vibro-Tactile Research Laboratory, Smith College, Northampton, Mass., "The Interpretation of Speech by Tactual and Visual Impression."
- Thursday, March 31. H. A. Lorentz, Ph.D., F.R.S., Professor of Physics, University of Leiden, Holland, "How Does an Atom Radiate Light?"
- Thursday, April 7. Edward Capps, Professor, Department of Classics, Princeton University, Princeton, N. J., Chairman of Managing Committee, American School of Classical Studies at Athens, "Excavation of Athens."
- Thursday, April 14. W. F. G. Swann, Sc.D., Director, Sloane Physics Laboratory, Yale University, New Haven, Conn., "What Is Left of the Atom."
- Wednesday, April 20. A. H. Markwart, Vice-President, Pacific Gas and Electric Company, San Francisco, California, "Power in California."
- Wednesday, May 18. Medal Day.

## BARTOL RESEARCH FOUNDATION LECTURES

LECTURES BY R. WHIDDINGTON, M.A., D.Sc., F.E.S.

CAVENDISH PROFESSOR OF PHYSICS, DEAN OF THE FACULTY OF SCIENCE,  
UNIVERSITY OF LEEDS, ENGLAND

Wednesday, October 13, 1926, at Four O'Clock, P.M.

THE LUMINOUS DISCHARGE THROUGH RARE GASES

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LECTURES BY PROFESSOR R. C. TOLMAN

CALIFORNIA INSTITUTE OF TECHNOLOGY

November 17, at Eight-Fifteen O'Clock, P.M.

November 19, at Four O'Clock, P.M.

November 22, 1926, at Four O'Clock, P.M.

Wednesday, November 17—"THE METHODS OF STATISTICAL MECHANICS."

Comparison of the methods of ordinary and statistical mechanics. Comparison of the methods of statistical mechanics and thermodynamics. Ensemble and phase. Phase spaces. Distribution of ensemble in phase. Change in density of distribution with time (Liouville's theorem). Application to molecular systems. Ergodic hypothesis.

Friday, November 19—"SOME APPLICATIONS OF STATISTICAL MECHANICS TO SYSTEMS THAT ARE IN EQUILIBRIUM."

The Maxwell-Boltzmann distribution law. The Maxwell distribution law. Molecular collisions. The general equipartition law. Modifications introduced by quantum theory. Use of new form of Maxwell-Boltzmann distribution law. Application of statistical mechanics to concentrated systems. The prin-

principle of dynamical reversibility. The principle of microscopic reversibility. Applications.

Monday, November 22—"SOME APPLICATIONS OF STATISTICAL MECHANICS TO SYSTEMS THAT ARE CHANGING TOWARDS THE CONDITION OF EQUILIBRIUM."

Boltzmann's H-Theorem. Extensions of the H-Theorem. Critique of the H-Theorem. Transport problems. Rate of chemical reaction. The existence of homogeneous non-catalyzed gas reactions. The rate of decomposition of nitrogen pentoxide. The temperature coefficient of rate of decomposition. The mechanism of activation. The transfer of energy to molecules.

# **CHRISTMAS WEEK LECTURES FOR YOUNG PEOPLE BY ROBERT W. WOOD**

PROFESSOR OF PHYSICS, JOHNS HOPKINS UNIVERSITY, BALTIMORE

December 27, 28, 30 and 31, 1926, at Three O'Clock, P.M.

## **RECREATIONS WITH RADIATIONS**

Monday, December 27, 1926

Analogies between sound and light. Waves originated by vibrators. Things that vibrate. Interference of sound-waves, two sounds producing silence. Resonance: a vibrator set in motion by waves. Detectors of sound and light other than the ear and eye. Singing flames and the rotating mirror. Beats between two flames of different pitch. Flames that hear notes inaudible to the ear, and flash in rhythm to the ticking of a watch.

Rijke's tube or the organ pipe that blows itself. High frequency sounds that destroy life. Water jets that are sensitive to sound. Why the drops scatter in a fountain. Scattering prevented by electricity. How rain drops form and why we have large drops in a thunderstorm. Can rain be induced artificially?

Rain makers and their devices.

Stroboscopic experiments with the fountain.

Electrical vibrators and Hertz waves. An electrical system that pulsates every three seconds.

TUESDAY, DECEMBER 28, 1926

Why we think that light consists of waves. White light and colored light. A lamp which causes moving white objects to appear in brilliant colors, though stationary objects appear white. Lamps that show all objects as uncolored. Why objects appear colored. Colors produced by absorption (body color) and by selective reflection (surface color).

The colors of the sky and sun-set colors.

The spectrum. Absorption and emission spectra. Metals that burn. How the spectroscope tells us what the sun and stars are made of.

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THURSDAY, DECEMBER 30, 1926

Fluorescence substances which manufacture light of one color when illuminated by light of another color. Phosphorescence substances or storage batteries for light.

Interference of light. The colors of thin films. The opal and reflection by multiple films. Chlorate of potash iridescent crystals. Stationary light waves. Lippman's color photographs.

Polarized light. Two perfectly transparent substances are opaque to light in a certain position.

Colors shown by crystals and minerals in polarized light.

FRIDAY, DECEMBER 31, 1926

Invisible light. Infra-red rays and how they are detected. Ultra-violet light. Uses of invisible light in peace and war. Secret signalling. Experiments with the ultra-violet lamp. Fluorescence and phosphorescence under ultra-violet light. Squeezing the stored light out of phosphorescent substances by infra-red rays.



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- AMES, Dr. JOSEPH S.**, Director, Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
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 Freeman, W. W.  
 Lloyd, John Uri.  
 Muller, E. A.

**Cleveland**

Abbott, Robert R.  
Cox, J. D.  
Doane, Samuel E.  
Gfrorer, A. H.  
Jefferies, Zay.  
Karrer, Enoch.  
Lihme, I. P.  
Luckiesh, M.  
MacBain, D. R.  
Oetting, O. W. A.  
Parkin, Chas. H.  
Smith, Albert W.  
Smith, G. W. Jr.

**Columbus**

Smith, Iowa.  
Stout, Orin C.

**Dayton**

Ohmer, Will I.  
Tait, Frank M.  
Toulmin, H. A.  
Wright, Orville.

**Massillon**

Mitchell, W. M.

**Middletown**

Eppelshimer, Daniel.

**Worthington**

Fitz, E. M.

**OKLAHOMA****Ponca City**

Eckhardt, E. A.

**OREGON****Grants Pass**

Canby, William W.

**Portland**

Bilyeu, Thomas.

**PENNSYLVANIA****Abington**

Merritt, James Smith.

**Allentown**

Trexler, Harry C.  
Sargent, C. E.  
Snelling, Walter O.

**Altoona**

Koch, G. B.  
Pease, F. N.

**Ambler**

Hagar, Walter F.  
Smith, Irving B.

**Ardmore**

Bright, John Irwin.  
Erne, Alfred.  
Kent, A. Atwater.  
Sellers, Horace W.  
Spackman, H. S.  
Worrell, Howard S.

**Bellevue**

Lower, Nathan M.

**Bethayres**

Lippincott, Joseph W.

**Bethlehem**

Ford, Terrance.  
Kinnier, G. E.  
Rau, Albert George.  
Richards, C. R.  
Wilbur, W. A.

**Bridgeport**

Landt, G. E.

**Bryn Athyn**

Boericke, Felix A.  
Howard, Wilfred.

**Bryn Mawr**

Barnes, James.  
Crenshaw, James L.  
Ferree, Clarence Errol.  
Fieser, L. F.  
Horn, David W.  
Pillmore, G. U.  
Schlacks, C. H.  
Smith, W. Hinckle.  
Townsend, J. W.  
Vaux, George, Jr.  
Wood, Allen, 3rd.

**Bristol**

Hollander, Charles S.  
Nielson, D.

**Brookline**

Holst, L. J. R.

**Butler**

Christianson, A.

**Burnham**

Skinner, O. C.

**Chester**

Hart, Charles.  
Kucher, A. A.  
Nethery, H. J. W.  
Palmer, T. Chalkley.  
Palmer, Walter.  
Shattuck, John D.  
Stevenson, S. Price.  
Wetherill, Robert.  
Woodbury, C. A.

**Chester Heights**

Moore, Horace E.

**Christiana**

Bondon, L. B.

**Clearfield**

Graham, W. F.

**Coatesville**

Huston, Chas. L.  
Ridgway, Ellis B.  
Ridgway, William H.

**Conshohocken**

Wood, Biddle.

**Cynwyd**

Haupt, Lewis M.

**Darling**

Willcox, W. F.

**Devon**

Walker, J. W.  
Welsh, Francis Ralston.

**Easton**

Brown, G. S.  
Cornelius, J. C.  
Hart, Edward.  
Raymond, Ward.  
Shimer, Porter W.  
Wilson, J. Hunt.

**Elkins Park**

Lamb, Newton.

**Elwood City**

Brownstein, Benjamin.

**Erdenheim**

Wood, Robert L.

**Erie**

Durban, Thomas E.

**Franklin**

Rhoades, Joseph J.

- Fullerton**  
Kinyon, A. G.
- Glen Moore**  
Howson, Emily E.
- Glenolden**  
Nichols, Leon W.
- Greenburg**  
Donohoe, John P.
- Harrisburg**  
Irons, Robert H.  
Masters, Frank M.
- Haverford**  
Bailey, Raymond.  
Bostwick, J. V.  
Curwen, Samuel M.  
Felton, E. C.  
Klemm, J. G., Jr.  
Lewis, Wilfred.  
Lohmann, A. P.  
Measey, William M.  
Moore, Coleman B.  
Morris, A. Saunders.  
Palmer, Frederick.  
Robinson, Anthony W.  
Sawtelle, William Otis.  
Sharpe, J. S.  
Siesler, George J.  
Woolman, Edward.
- Hazleton**  
Markle, A.
- Irwins**  
Miles, J. Walter.
- Jenkintown**  
Benzon, George H., Jr.  
Brewer, R. W. A.  
Gibson, Henry Clay.  
Goodwin, Harold, Jr.  
Keller, H. H.  
Newbold, C. B., Jr.  
Redding, Chas. S.
- Johnstown**  
Crichton, Andrew B.
- Kennett Square**  
Philips, Edwin S.
- Lancaster**  
Adams, B. F.  
Widmyer, J. H.
- Lansdowne**  
Andersen, Robert.  
Deshong, Howard T.  
Huttinger, W. R.  
Keay, L. K.  
Pennock, George L.  
Roberts, Charles C.  
Wilson, Alexander, 3rd.
- Lock Haven**  
Dunn, Chas.
- Mahanoy Plane**  
Sloatman, W. S.
- Marcus Hook**  
Griffin, Frank H.  
Smith, W. Leigh.
- Mechanicsburg**  
Strong, William Walker.
- Media**  
Bell, J. P.  
Wilson, J. L.
- Melrose Park**  
Hyatt, Clinton Brown.
- Merion**  
Boericke, John J.  
Davis, R. W.  
Eglin, A. C., Jr.  
Shand, A. C.
- Millbourne**  
Sellers, Howard.
- Millersville**  
Davidheiser, Lee.
- Minersville**  
Snyder, Clinton F.
- Moylan**  
Sanderson, R. P. C.
- Narberth**  
Bates, O. W.  
Snyder, Monroe B.  
Wilhelm, R. H.
- New Hope**  
Miller, Fred. J.
- Norristown**  
Place, Samuel.  
Stinson, Robert.
- Oakmont**  
Elsay, H. M.
- Paoli**  
Smith, P. F., Jr.
- Parksburg**  
Beale, Horace A., Jr.
- Phoenixville**  
Rapp, I. M.  
Wetherill, H. E.
- Philadelphia**  
Abrams, Peter.  
Adams, Wm., Jr.  
Aiken, Frank.  
Akimoff, Nicholas W.  
Albrecht, A. O.  
Albrecht, Herman O.  
Allen, Arthur H., Jr.  
Allen, Henry B.  
Allen, William N.  
Anderson, Cyrus N.  
Armstrong, William R.  
Arnstein, H.  
Ashhurst, John.  
Ashworth, H.  
Atterbury, W. W.  
Austin, W. L.  
Ayers, Eugene E.  
Babcock, A. F.  
Baker, George F.  
Balch, Alfred C.  
Balls, William H.  
Baldwin, Frederic E.  
Banta, Clifford.  
Barba, M. B.  
Barnes, John H.  
Barnett, Edwin S.  
Barringer, D. M.  
Bates, E. F.  
Bazzoni, C. B.  
Beale, Leonard T.  
Beath, E. R.  
Behr, Leo.  
Belfield, T. B.  
Bement, A. C.  
Bement, W. P.  
Bennett, J. S.  
Biddle, Elizabeth C.  
Biddle, Robert.  
Bilgram, Hugo.  
Binder, Richard L.  
Binswanger, J. G.  
Birkinbine, Carl P.  
Blackburn, Caroline D.  
Blair, A. A.  
Blake, A. E.  
Blum, Arthur N.  
Bodine, G. L., Jr.  
Bodine, S. T.  
Boekel, J.  
Boley, O. H.

## Philadelphia—Continued

Bonine, Charles E.  
 Bonn, N. E.  
 Boos, H. O.  
 Borie, Beauveau Jr.  
 Borton, George W.  
 Bower, W. H.  
 Bowen, Samuel B.

H.

I.

E.

Starr

H.

Brown, Francis Shunk.  
 Brown, Richard P.  
 Brown, W. L.

I.

Jr.

Bureau, E. W.  
 Burroughs, Joseph H.  
 Burton, M. C.

Calvert, Harold.  
 Capp, S. Bunker.  
 Card, P. Q.  
 Cary, C. Reed.  
 Chambers, Francis T.  
 Chambers, J. Howard.  
 Chance, E. M.

C.

Clark, E. W.  
 Clark, Edward L.  
 Clark, Joseph S.  
 Clark, Theobald F.  
 Clark, Walton.  
 Clark, Mrs. Walton.

lead.

S.

3rd.

Dannenbaum, Herman.  
 Daubell, P. T.  
 Davis, C. E.

Dawes, John H.  
 Day, Charles.  
 DeKrafft, W.  
 Dellbridge, T. G.  
 Dercum, F. X.  
 Dieffenbach, A. C.  
 Dike, P. H.

I.

D.

A.

Dodge, Kern.  
 Dougherty, T. H., Jr.  
 Douredoure, Bernard L.  
 Downs, W. F.  
 Doyle, William J.  
 Drexel, John R.

R.

ick.

I.

W.

W.

Jr.

Emerich, L. E.  
 Emerick, J. M.  
 Erikson, R. B.  
 Erne, Alfred.  
 Evans, O. B.  
 Evans, Powell.  
 Evans, Wayne S.  
 Fairchild, S. E., Jr.  
 Faught, L. Ashley.  
 Fearing, Frederick C.  
 Fearon, Charles.  
 Fels, Maurice.  
 Fels, Samuel.  
 Ferguson, W. B.  
 Fernald, R. H.  
 Finkbinder, E. W.  
 Fiore, Andrew.  
 Fisher, Thomas.  
 Fitzmaurice, William J., Jr.  
 Fletcher, W. E.  
 Ford, Bruce.  
 Forstall, Walton.  
 Francis, Isaac H.  
 Francis, John K.  
 Franklin, Benjamin.  
 Frazier, George H.  
 Frazier, W. W.  
 Fry, Ann W.  
 Fuguet, H.  
 Fulweiler, J. H.

I.

GF

Galloway  
 Garrison, F. Lynwood.  
 Gartley, William H.  
 Gassam, J. M.  
 Gerhard, Arthur Howell.  
 Gest, William P.  
 Gibbs, A. E.  
 Gibbs, W. S.

Godfrey, H. L.  
 Goetzenberger, Ralph L.  
 Goldbaum, Jacob S.  
 Goldsmith, Edwin M.

*Philadelphia*—Continued

Goodspeed, Arthur W.  
 Grafton, E. H.  
 Greenwood, Richard.  
 Greer, W. N.  
 Grevemeyer, G. A.  
 Gribbel, John.  
 Gribbel, W. Griffin.  
 Griest, Thomas H.  
 Griscom, Leslie.  
 Grosscup, H. A.  
 Gucker, F. T.  
 Hachikian, Charles.  
 Hackett, H. B.  
 Haines, Caspar Wistar.  
 Haines, Robert B., Jr.  
 Haines, William A.  
 Hall, O. A.  
 Hall, George R.  
 Hanthorn, Joseph R.  
 Harris, Bert M.  
 Harrison, A. C.  
 Harrison, O. C.  
 Harrison, G. L.  
 Harrison, J. K. M.  
 Harrison, Thomas R.  
 Harsch, J. W.  
 Hartung, Adolph.  
 Hartzel, Francis W.  
 Hayner, J. W.  
 Hayward, Nathan.  
 Heilprin, William A.  
 Helme, William E.  
 Hendrixson, L. H.  
 Henson, Edward Francis.  
 Hentz, R. A.  
 Hepburn, Joseph S.  
 Hering, Walter E.  
 Hess, J. C., Jr.  
 Hiergesell, Valentine.  
 Higgins, E. S.  
 Hires, Charles E.  
 Hofstetter, George.  
 Holland, Walter E.  
 Hopping, Ernest L.  
 Horn, Franklin S.  
 Houston, John J. L.  
 Houston, Samuel F.  
 Howe, Arthur W.  
 Howson, Charles Henry.  
 Howson, Henry.  
 Howson, Richard.  
 Hoy, R. V., Jr.  
 Huber, D. M.  
 Hughes, R. J.  
 Hummell, Willard A.  
 Hurst, William.  
 Hutchinson, S. Pemberton.  
 Hyman, J. D.  
 Indahl, Mauritz O.  
 Ingersoll, Charles E.  
 Irish, W. M.  
 Israel, Joseph D.  
 Ives, Fred E.  
 Jackson, William Steell.  
 James, William Fry.  
 Jeanes, Isaac W.  
 Jenkins, Theodore F.  
 Jennings, W. N.  
 Johnson, O. N.  
 Johnson, Ernest.  
 Johnson, J. O.  
 Johnson, W. H.  
 Johnson, William A.  
 Jones, Julian D.  
 Justi, Henry M.  
 Kabakjian, D. H.  
 Kaltenthaler, H. J.  
 Kavanaugh, William H.

Kellog, Hosford D.  
 Kelly, George L.  
 Kennedy, Frank G.  
 Kennedy, M. C.  
 Kent, S. Leonard, Jr.  
 Kercher, M. A.  
 Kerr, William M.  
 Ketcham, O. W.  
 Ketterlinus, J. L.  
 Kimber, W. M. C.  
 King, Joseph B., Jr.  
 Kinnard, L. H.  
 Kirsopp, E. C. B.  
 Kline, O. M.  
 Klumpp, John Bartleman.  
 Knapp, Arthur.  
 Kneass, Strickland L.  
 Kohn, Joseph.  
 Kraus, E. R.  
 Krauss, George.  
 Kuehn, T.  
 Kuesel, G. O.  
 Landreth, O. P.  
 Lanza, G.  
 Lauer, Conrad.  
 Lavino, E. J.  
 LaWall, Charles H.  
 Lay, John Tracy.  
 Ledoux, J. W.  
 Lee, Elisha.  
 Lee, James D.  
 Lee, Walter T.  
 Leeds, Morris E.  
 Leffmann, Henry.  
 Leighninger, William B.  
 LeMaistre, F. J.  
 Lemoine, L. R.  
 Leopold, L. S.  
 Lealey, Robert W.  
 Levy, Howard S.  
 Levy, Lionel F.  
 Lewis, A. Nelson.  
 Lewis, Howard W.  
 Lewis, John F.  
 Lewis, Robert B.  
 Lillebridge, H. W.  
 Lillie, Lewis.  
 Lillie, S. M.  
 Littleton, W. G.  
 Lippincott, J. Bertram.  
 Liversidge, Horace P.  
 Lloyd, Herbert.  
 Lloyd, Malcolm, Jr.  
 Lonergan, J. E.  
 Longstreth, E. T.  
 Lowe, Arthur W.  
 Loyd, Sarah A. C.  
 Lukens, Hiram S.  
 Lupton, Edward.  
 Lyon, Percy S.  
 Lysle, Frederic Bowers.  
 McAllister, T. S.  
 McArthur, George P.  
 McBride, Thomas O.  
 McCain, G. N.  
 McCall, Richard O.  
 McConnell, Franklin P.  
 McCormick, William.  
 McDowell, Charles.  
 McGeorge, Percy.  
 McLean, William L.  
 McVey, John Joseph.  
 Macfarlane, J. M.  
 Madeira, Percy O.  
 Mallery, Otto T.  
 Manwaring, A. H.  
 Marshall, J. T. W.  
 Martin, Thomas S., 3rd.  
 Martocello, Joseph A.

## Philadelphia—Continued

Masland, Charles H., 2nd.  
 Mason, W. C.  
 Maury, M. F.  
 Mears, A. H.  
 Mecker, G. H.  
 Mellor, Norman.  
 Melody, Michael.  
 Merrick, J. Hartley.  
 Merrick, J. V.  
 Metten, John F.  
 Miller, J. M.  
 Miller, Simon.  
 Milne, David

Jr.

Jr.

Morgan, Marshall S.  
 Morris, Edingham B.

A.

need.

Parker, H. O.  
 Parker, John O.  
 Patterson, Francis D.  
 Patterson, J. Edward.  
 Paul, H. N.  
 Pearson, Joshua.  
 Peck, G. L.  
 Peck, S. B.  
 Pecker, Joseph S.  
 Pemberton, Ralph.  
 Pender, Harold.  
 Penrose, Charles.  
 Penrose, R. A. F., Jr.  
 Pepper, David.  
 Perot, T. M., Jr.  
 Perrot, Emile G.  
 Pew, J. Howard.  
 Picolet, Lucien E.  
 Pierce, G. A.  
 Plack, W. L.  
 Plann, William.  
 Platt, H. H.  
 Pond, S. E.  
 Porter, Horace C.  
 Porter, J. B.  
 Porter, Roland G.

V

H

W.

Price, M. M.  
 Quimby, Henry H.  
 Raff, A. Raymond.  
 Rankin, H.  
 Rea, Samuel.  
 Reath, Theodore W.  
 Rebmann, H. G. R.  
 Reichardt, H.  
 Reilly, Marion.  
 Resines, Javier.

J.  
 E.

Rogers, Frank H.  
 Rogers, James S.  
 Rolle, Sylvan D.  
 Rondinella, L. F.  
 Roosevelt, Nicholas G.  
 Z.

Morris.

Rosengarten, Frederic.  
 Rosengarten, George D.  
 Ross, Howard.  
 Ross, R. W.  
 Ross, T. Edward.  
 Roulton, J. A.

ore S.

J.  
 J.

S.  
 sk H.

Sailer, R.  
 Salom, Pedro G.  
 Samuel, J. Bunford.  
 Sanborn, Edward H.  
 Sanford, Rufus H.

Sellers, Coleman, 3rd.  
 ownsend.

A.  
 L.  
 uel.  
 mas H

Shrader, J. E.  
 Shuman, F. R.  
 Shumay, E.  
 Simachn, Julian A.  
 B.  
 Jr.

Smith, Edward W.  
 Smith, Hazeline.  
 Smith, S. D.  
 Smith, Walter B.

C.  
 A.

Stammet A V

*Philadelphia—Continued*

Stroud, E. A.  
 Styri, Haakon.  
 Supplee, W. H.  
 Swaab, S. M.  
 Sykes, John P.  
 Synnestvedt, Arthur.  
 Taggart, Walter T.  
 Tatnall, J. S.  
 Taylor, H. Birchard.  
 Taylor, Hollingshead N.  
 Taylor, Loundes.  
 Thomas, Arthur H.  
 Thompson, A. W.  
 Thompson, Paul.  
 Thwing, Charles Burton.  
 Tily, H. J.  
 Towle, H. L.  
 True, Rodney H.  
 Trueman, William H.  
 Tull, C. E.  
 Tuttle, E. B.  
 Tuttle, William C.  
 Tyler, Sydney F.  
 Vail, James G.  
 Van Dyke, J. W.  
 Vauclain, S. M.  
 Vogdes, J. J.  
 Vogelsson, John A.  
 Vollrath, Alfred J.  
 Wagner, John.  
 Wagner, Samuel T.  
 Wagner, Walter C.  
 Waidlich, J. E.  
 Wallis, J. T.  
 Walton, Horace.  
 Warden, William G.  
 Warner, William R., Jr.  
 Warnock, James.  
 Warriner, S. D.  
 Watson, James.  
 Weatherwax, James Lloyd.  
 Webber, G. C.  
 Webster, George S.  
 Webster, William R.  
 Weinberg, S.  
 Welles, Howard W.  
 Weltz, E. H.  
 Wetherill, William C.  
 Weyl, Charles N.  
 Wharton, Henry.  
 Whitaker, James L.  
 White, J. Atwood.  
 Whitney, E. R.  
 Whitney, F. E.  
 Wiegand, John.  
 Willie, H. V.  
 Williams, Alfred L.  
 Williams, E. D.  
 Williams, Ira Jewell.  
 Williams, T. W.  
 Williams, William J.  
 Williamson, J. D., Jr.  
 Wilson, Arthur M.  
 Wilson, H. A.  
 Wilson, H. D.  
 Wilson, Henry W.  
 Wilson, James E.  
 Wolf, John Jacob.  
 Wood, Albert C.  
 Wood, E. R., Jr.  
 Wood, Walter.  
 Woodbridge, J. Lester.  
 Woodward, George.  
 Wright, Frank L.  
 Wright, S. L., Jr.  
 Wurtz, C. S.  
 Wyatt, James H.  
 Wyatt, J. R.

Wyeth, F. H.  
 Wyle, Bruce.  
 Yarnall, D. Robert.  
 Young, C. A.  
 Zimmermann, John E.  
 Zimmermann, William.

*Pittsburgh*

Chesterman, F. J.  
 Crawford, D. F.  
 Cunningham, J. L.  
 Didier, Paul.  
 Eavenson, Howard N.  
 Garman, F. R.  
 Gunn, Donald.  
 Hower, Harry S.  
 Jones, Jonathan.  
 Koch, J. A.  
 Marbaker, Edward.  
 Milliken, J.  
 Moore, W. E.  
 Ramsburg, O. J.  
 Rittman, W. F.  
 Rugg, W. S.  
 Skinner, O. E.  
 Sperr, F. W.  
 Taber, George H.  
 Tiemann, Hugh P.  
 Wadsworth, F. L. O.  
 Weidlein, Edward R.  
 Whitney, Louis B.

*Pottstown*

Forstall, C. F.  
 Fretz, E. S.

*Radnor*

Scott, William M.

*Reading*

Heilman, D. B.  
 Heiser, C. E.  
 Lerch, G. R.  
 MacLean, L. W.  
 Moorehouse, J. W.  
 Thomas, L. E.  
 Woodroffe, G. H.  
 Young, J. Bertram.

*Ridley Park*

Manning, E. R.  
 Woodle, Allan S., Jr.

*Roscmont*

Archbald, Sara T.

*St. Davids*

Freeman, Harold A.

*Scottdale*

Oberly, Albert D.

*Sellersville*

Landis, D. O.

*Springfield*

Kent, R. H.

*State College*

Wendt, Harold L.

*Strafford*

Kothny, G. L.

*Stroudsburg*

Smith, H. S. S.

*Sunbury*

Lenker, Will G.

*Swarthmore*

Alleman, Gellert.  
 Creighton, H. Jermain.  
 Elmore, G. H.  
 Hoadley, George A.  
 Hollister, S. O.



Parsons, L. A.  
 Sagebeer, Richard C.  
 Sellers, Richard C.  
 Temple, Edward B.  
 Wright, Winthrop R.

*Swedeland*  
 Tiddy, William.

*Swissvale*  
 Grondahl, L. O.

*Tamagua*  
 Hill, Roy Linden.  
 Pratt, Carl D.

W., Jr.

Wh

*Verona*  
 Rodman, Hugh.

*Villa Nova*  
 Dolan, Thomas J.  
 McClenahan, John M

*Virginville*  
 Tait, E. H.

*Wallingford*  
 Biddle, James G.  
 Müller, Casper W.  
 Trautwine, John C., 3rd.

*Wawa*  
 Wilcox, James M.

*Wayne*  
 Idd  
 W.

Red

*West Chester*  
 Chrisman, C. S.

V.

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*White Haven*  
 Ballantine, Stuart.

*Wyebrooke*  
 Potts, William M.

*Wyncote*  
 Kingsford, R. T.

*Wynnewood*  
 Boericke, Gideon.  
 Hall, R. T.  
 Lovekin, L. D.  
 Weston, F. W.

#### RHODE ISLAND

*Bristol*  
 Herreshoff, Nathaniel G.

*Providence*  
 J.  
 M.

*Saunderstown*  
 Griffith, W. O.

#### SOUTH CAROLINA

*Sumter*  
 Mason, Charles Thomas.

#### TENNESSEE

*Bristol*  
 Whitney, Am.

*Knoxville*  
 Gleaser, Jean V.

*Nashville*  
 MacDonald, Hunter.

#### TEXAS

*College Station*  
 Neblette, Carol B.

*Galveston*  
 Dawson, W. T.

#### UTAH

*Salt Lake City*  
 Anderson, Frank.

#### VERMONT

*Bennington*  
 Beach, Charles S.

*Springfield*  
 Fellows, E. R.  
 Flanders, Ralph E.  
 Hartness, James.

#### VIRGINIA

*Charlottesville*  
 Dunnington, F. P.

*Hampton Institute*  
 Atkinson, Robert.

*Nokcville*  
 Harrison, Mitchell.

*Norfolk*  
 Caples, M. J.

*Warrenton*  
 Randolph, A. M.

#### WASHINGTON

*Seattle*  
 Collins, C. R.

*Rosario*  
 Moran, Robert.

#### WEST VIRGINIA

*Fairmont*  
 Huff, E. L.

#### WISCONSIN

*Appleton*  
 Power, Archie Dayton.

*Beloit*  
 Suydam, V. A.

*DeLafield*  
 Anderson, G. L.

*Madison*  
 Lenher, Victor.  
 Mathews, J. H.  
 Swenson, Magnus.

*Milwaukee*  
 Beck, M. A.  
 Frank, Edwin.  
 Harvey, R. P.  
 Hatton, T. Chalkley.  
 Uehling, E. A.  
 White, A. Raymond.  
 White, W. M.

## FOREIGN

## ARGENTINA

*Buenos Aires*  
Gottschalk, Otto.

## AUSTRALIA

*Sydney*  
Robertson, H. C.  
*N. S. Wales*  
Leech, T. D. J.

## BRAZIL

*Rio de Janeiro*  
Billings, A. W. K.  
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